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EDITORIAL

THE ATROPHIC RHINITIS ORDER

THE publication of the Atrophic Rhinitis Order (1954) is a timely reminder that Britain can no longer rely entirely on the sea to protect her from invasion by exogenous diseases. Science has made great progress in the last hundred years and especially so during that part encompassed in the 20th century. Probably the greatest advances have been made in the realms of transport and inaccessible areas are now within a few hours of the homeland because of the spectacular development of aerial travel. It is within this sphere that the questions appertaining to the introduction of diseases which affect plants, animals and man are of most serious moment. All infective and contagious diseases pass through that phase which is commonly called the incubation period. This may be long or short and therein lies the danger. If the incubation period were the same in all diseases, then defensive measures would be simplified and adequate protection assured almost as a routine measure. Unfortunately this is not the case. Some incubation periods are very short, by comparison others are long, and in most cases there is no outward warning detectable to the clinical eye that all is not well. The severity of the disease, and its spread, is often proportional to the shortness of this period and therefore the rapidity of certain forms of modern transport is fraught with danger. Under the more leisurely conditions of travel and conveyance of the 19th century there was time to think and act and in many cases there was evidence of the existence of a disease before the animal reached its final destination. Laborious and

(*The June issue of The British Veterinary Journal was published on June 3*).

slow transport placed some restrictions upon the distance that a disease could be carried away from the site of origin and the economic repercussions of a journey of several weeks or even months also played their part by acting as a brake upon the movements of animals. We could abide in peace whilst plagues beset Europe, Asia and Africa. This long term freedom from the fear of invasion has been dispelled quickly by the development of air carriage, for an animal can be in Asia or Africa to-day and in London on the morrow. Our own relative freedom from most of the devastating diseases, once a potent factor which helped to make these islands the best stock nursery of the world may now act to our own disadvantage. Endemic disease stimulates natural resistance and conversely the power of resistance varies according to the persistence or vigour of the attack. The virulence of the invader also changes according to the resistance of the potential host. Epidemics rage when resistance is low because of the want of active stimulus. Epidemics decimate when the virulence of the attacker overcomes the resistance of the attacked, but in those that survive the tables are turned. The incidence of infective disease can be depicted graphically in a series of curves. The peaks indicate the time when, for want of action and constant stimulus, the resistance is low. The fall of the curve is the natural consequence of a rise in defensive power, the depth of the curve marks the time when resistance again assumes its conquering roll and victory is assured.

The progress of the invader therefore depends upon the state of the "soil." In the case of endemic disease resistance may fall to a low level but some degree of defence which can be amplified is always there. When an exogenous disease gains access to a country, which for want of endemic stimulus, is completely defenceless, then widespread epidemics of a virulent type are inevitable. No sensible person would advocate the introduction of a virulent disease to these islands in order to produce a natural resistance. Our freedom from such calamities can only be assured by the strictest quarantine measures and by the immediate introduction of legislative control. Those with whom the responsibility rests must be alert and ever on the watch for the first indication of the introduction of any infective disease.

We welcome the Atrophic Rhinitis Order for it is an indication that those responsible for the protection of our flocks and herds are "on the job."

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GENERAL ARTICLES

MÆDI, A SLOW PROGRESSIVE PNEUMONIA OF SHEEP: AN EPIZOOLOGICAL AND A PATHOLOGICAL STUDY

By BJÖRN SIGURDSSON,

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A CHRONIC pneumonia of sheep was prevalent in Iceland from 1939 to 1952 (Sigurdsson *et al.*, 1952, 1953) and except for general emaciation, distinctive anatomical changes were found in the lungs and tracheobronchial lymph nodes only.

The evidence suggests that the disease is contagious and that it has a very long incubation period—one to three years or more. Its cause is not definitely known although it is suspected to be of virus origin. In Iceland the disease is referred to by the name " mædi," which really means dyspnœa. Mædi appears to have been introduced into Iceland in 1933 with sheep imported from Germany. In that year the Icelandic government purchased 20 sheep of karakul breed from Halle, Germany. On arrival they were placed in quarantine for some weeks and after that distributed to 16 farms scattered all over the country. Each farmer received one ram except in one case where five animals, some of them ewes, were kept together.

It seems that at least two of the imported sheep carried the infection and gave rise to outbreaks in two widely separated districts.

Mædi should be clearly distinguished from infectious adenomatosis or jaagziekte which undoubtedly was introduced at the same time and is also a chronic infection of sheeps' lungs (Dungal, *et al.*, 1938, Dungal, 1946).

The reasons for concluding that these are two different diseases are in the first place that they look and behave very differently both clinically and anatomically. Also, they have occurred separately in certain districts for several years at a time although they have been found together in other areas.

It was not until approximately six years after the sheep were imported that it was realised that a new and previously unknown disease was rampant. In the following years the disease spread over wide areas. (See Maps 1, 2 and 3). The maps and other epidemiological data concerning this disease have been prepared by Dr. Gíslason, who has studied the natural history of mædi since its introduction into Iceland and during its rise and decline. Dr. Gíslason estimates that during the years 1939 to 1952 at least 150,000 animals were lost from mædi.

This is the first of three Special University Lectures given in the University of London in March, 1954. The title of the series was: *Observations on three slow infections of sheep.*

In 1939 mædi was prevalent in an area containing about 50,000 sheep. When the epizootic reached its maximal distribution in 1946 it involved an area numbering about 200,000 sheep. After that the number of exposed sheep declined gradually being about 40,000 in 1951.

Losses from mædi on individual farms and in the whole districts were extremely heavy. A mortality of 10 to 20 per cent per year was common on many farms and this continued year after year without evidence that the epizootic was going to subside or that resistant strains of sheep were emerging. Sheep farming under these circumstances was a hopeless task and in spite of government subsidies the situation became desperate for many farmers.

There were no methods of control available and the Icelandic government tried to combat this serious condition by launching a programme of organised slaughtering in the infected districts. The disease was first recognised by Dr. Gíslason in 1939 and the systematic destruction of the sheep in the infected areas was begun in 1944 and finished in 1952 (Map 3). By the end of 1952 all the sheep in infected areas had been destroyed and lambs from uninfected areas had been introduced to replace them. Approximately 300,000 adult sheep were destroyed and about 180,000 healthy sheep were introduced into these areas.

Although mædi has not yet reappeared in these areas it is still too early to conclude that these measures have succeeded in eradicating it from the areas in question or from the country; any attempt to predict this would be futile as the mode of spread of mædi is not known and the infection has an extremely long incubation period.

Some of our experiences with this disease are herewith recounted. We believe mædi to have been introduced from Germany although it is apparently not known to occur there. It affects sheep two years or older. The first symptoms are usually a slowly advancing listlessness and loss of condition. This often becomes apparent after the sheep have been exposed to some unusual physical strain such as long driving or when the weather changes for the worse. An early sign is that the sheep become dyspnœic, and after physical exertion the respiration becomes very rapid and shallow. In contradistinction to epizootic adenomatosis mædi does not produce in the lung any appreciable quantity of fluid which could be poured out through the nostrils.

The frequency of respiration is above normal and sometimes excessively high or 80 to 120 per minute at rest. As the disease progresses the respiration becomes very difficult or laboured, even while the animal is at rest. In some cases coughing with more or less nasal discharge is observed.

The body temperature in uncomplicated cases is within the normal range, although possibly close to the upper limit.

As the disease advances and the sheep lose condition the hæmoglobin content of the blood decreases. This is not an early sign, but values as low as 7 to 8 gm. hæmoglobin per 100 ml. blood are sometimes found in the later stages. The normal value for hæmoglobin in sheep in Iceland is from 12 to 14 gm. per 100 ml. blood.

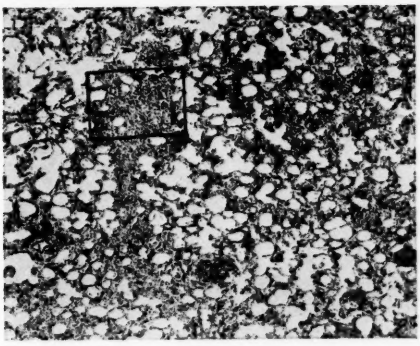

Fig. 1
A section of Mædi lung. An early lesion. x 14.

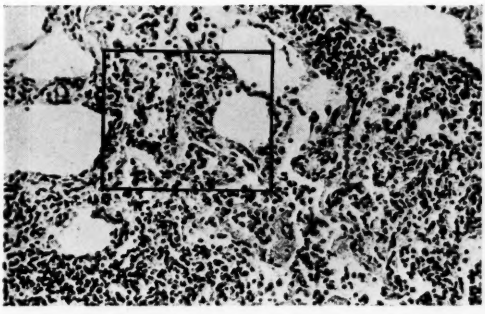

Fig. 2
Same illustration as Fig. 1. x 130.

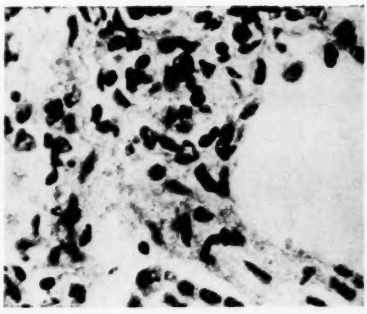

Fig. 3
As marked portion of Fig. 2. x 480.

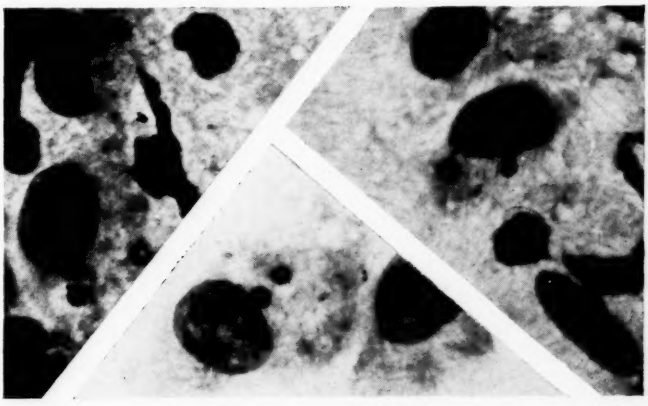

Fig. 4
Inclusions in cells from Mædi lungs. Giemsa-stained smear preparations. x 1575.

(Figures 5 and 6 appear on pages 261 and 262)

(*Article by Sigurdsson, page* 255)

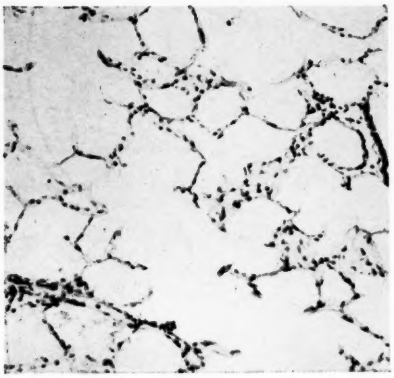

Fig. 7
Section of lung from normal control animal. x 125.

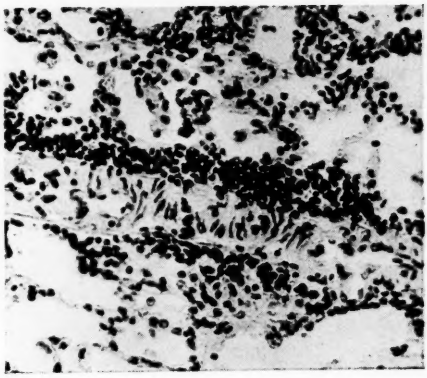

Fig. 8
A periarteriolar infiltrate with a few cells lying free in the alveoli. x 200.

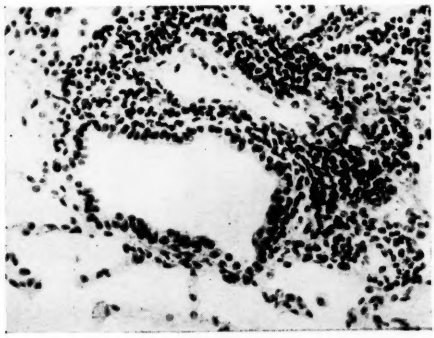

Fig. 9
A perivascular infiltrate with a considerable number of cells in the alveoli. x 200.

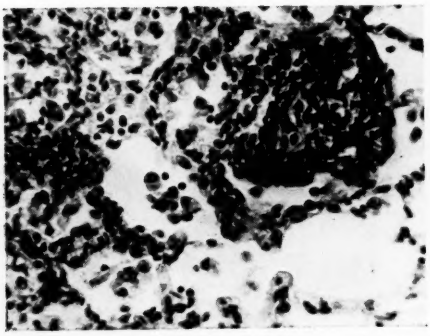

Fig. 10
A typical micropneumonia. Periarteriolar infiltrates and adjacent alveoli packed with cells. x 250.

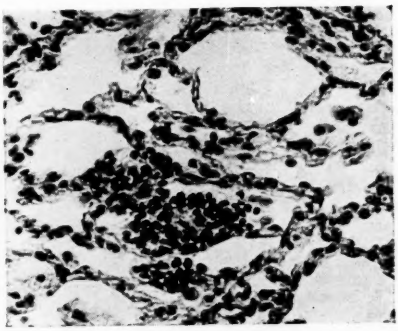

Fig. 11
A small periartiolar infiltrate. x 255.

(*Article by Sigurdsson, page* 255)

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The number of red cells also decreases but proportionately less than the hæmoglobin content, so that the anæmia is of the hypochromic type. The number of white cells in the blood of mædi cases varies generally from 6 to 12 thousand per mm.^{3}, averaging about 8.5 thousand per mm.^{3}. This is above normal as the normal figures found in Iceland are usually from 4 to 6 thousand per mm.^{3}.

Non-protein nitrogen of blood plasma is normal.

Total protein in plasma of diseased sheep is decreased or about 6 gm. protein per 100 ml. of plasma. The normal value for sheep in Iceland lies about 6.5 gm. protein per 100 ml. of plasma. It seems that it is the albumin-fraction of the protein which is low but that the amount of globulin is nearly normal.

The clinically recognisable stage of mædi may usually be expected to last for three to six months if the animal meets with no particular hardships. In certain cases symptoms last much longer, even for years. It is doubtful if recoveries ever occur. Under natural conditions sheep with mædi often succumb to a secondary acute pneumonia, showing a large number of the gram-negative pasteurella-like bacilli associated with acute pneumonia of sheep in Iceland and originally described by Dungal in 1931.

At autopsy, uncomplicated cases of mædi show no typical macroscopic changes outside the thoracic cavity. The carcase is usually thin, and there may be some serous fluid in the abdomen. When the thorax is opened the lungs collapse less than normally, and in a minority of cases fibrous adhesions are found covering a portion of the surface of one, or occasionally both lungs.

The most striking fact about the diseased lungs is their size. Normal sheep's lungs in Iceland usually weigh from 300 to 500 gm. but the lungs from mædi cases are two to four times heavier than normal. The tracheobronchial lymph nodes are also greatly enlarged. Table I shows the weight of the lungs and tracheobronchial lymph node in 10 consecutive cases of mædi autopsied in our laboratory.

The colour of mædi lungs also differs considerably from normal lung colour. It varies from greyish yellow to greyish blue. The diseased lungs are diffusely thickened and feel like a rubber sponge, although less elastic. The whole lungs are usually uniform in colour and consistency, i.e., the pathological changes seem to progress evenly throughout the whole organ with no normal lung tissue visible between. This is in contrast to many lung lesions where diseased and normal parts may be easily distinguished in the same pair of lungs. On the cut surface the tissue is rather dry, and it is homogeneous in colour and consistency. The consistency of the lung tissue in mædi is always very much softer than in ordinary pneumonic hepatisation. The larger bronchi may contain some mucus.

Microscopical examination reveals that the alveoli in lungs infected with mædi are infiltrated with numerous macrophages and the alveolar septa are thickened (Figs. 1, 2 and 3). Accumulations of lymphoid tissue are found

TABLE I

Weight of lungs and tracheobronchial lymph nodes in 10 cases of mædi in sheep (normal weight of lungs about 300 to 500 g.; normal weight of lymph nodes about 10 to 15 g.)

Sheep No.	Weight of lungs in grams	Weight of tracheo-bronchial lymph nodes in grams
173	1,120	30
174	1,140	28
175	1,330	45
176	1,160	56
177	860	0
179	1,040	24
181	1,810	34
182	970	65
183	1,800	48
184	950	26
Average	1,218	39·5

scattered throughout the lungs, and are at times very conspicuous. They are found close to a bronchus or a bronchiolus and it is somewhat difficult to assess the significance of this because in our experience minor accumulations of lymphoid tissues are frequently found in normal sheep's lungs also. Large solid areas are not usually seen in the slides, but in advanced cases the characteristic structure of the alveolar tissue is largely lost and the lung is transformed into strands of mesenchymal cellular tissue separated by irregular spaces which are infiltrated with large mononuclear cells. In such cases much more area in a given field is covered by the solid tissue than by air spaces. Presumably the alveolar septa have given rise to the bulk of the solid tissue, which is seen in the microscope. This would be concluded from the appearance of the tissue in lesions in an early stage rather than from the structure of the lung in advanced cases, where it is no longer possible to recognise many of the mesenchymal strands as septa. In young lesions the alveolar septa seem hyperæmic, but later in the disease there is some increase in fibrous tissue, and the smooth muscle normally found at the level of the alveolar ducts appears in many cases hypertrophic. The cellular exudate in the alveoli is composed mainly of the common alveolar macrophage. A few lymphocytes are also found but few, if any segmented leucocytes appear, except in cases where an acute pneumonia has supervened. In smears stained by Giemsa, the large mononuclear cells show protoplasmic inclusions of a soft greyish blue colour; they are almost perfectly round and vary in size from 1 to 3 mμ (Fig. 4). They may be single or multiple within a cell and I have not seen these inclusions in normal lungs or in other types of infections. The bronchial tree is, in general, remarkably free

of lesions, the epithelium usually being intact and the lumina free of exudate. It is a common finding, however, to see small epithelial formations outside the bronchi in the form of irregular cavities lined with cubical or cylindrical epithelial cells. These epithelial formations are never very extensive and to some extent they correspond to findings in influenza.

The enlarged tracheobronchial and mediastinal lymph nodes show a generalised hyperplasia and chronic inflammatory changes.

Inflammatory changes in the livers have been found in several advanced cases of mædi. These appear as small, scattered infiltrates of lymphocytes and plasma cells without apparent connection with the vessels of the liver.

This short description indicates that the anatomical changes in mædi combine the characteristics of a diffuse pneumonia of the virus type with the hyperplastic characteristics of a chronic pneumonia although fibrosis is not prominent in mædi. This relative absence of fibrosis may be related to the fact that the inflammatory process in mædi is not self-terminating, but a progressive one, and the well-known anatomical signs of healing, such as resolution or fibrosis, are therefore not observed.

It would be interesting to speculate as to why there are so few signs of a defensive reaction on the part of the host, in spite of the ample opportunity for this that should be given by the very long period that the disease lasts.

The conventional methods of classical bacteriology have failed to demonstrate in affected lungs a microbial agent that could be incriminated as the cause of the disease. If the animals are sacrificed before the onset of any secondary, terminal illness, their lungs are almost always sterile, when tested on the ordinary bacteriological media. Fungi have not been cultivated from diseased lungs either, and in a limited number of attempts pleuro-pneumonia-like organisms were not demonstrated. Sheep affected with mædi were tested by the intradermal method with histoplasmin, blastomycin, toxoplasmin and torula antigen; the animals did not react to these antigens. Aureomycin is without effect.

The possibility that a deficiency of the micro-elements, copper and cobalt, might have a significant relationship to this infection in Iceland was considered. A number of sera from sheep on an infected farm were analysed for copper, and the values were found to be normal. Samples of soil and herbage from infected districts were analysed for cobalt and the figures for cobalt were also normal.

Extensive feeding experiments with copper and cobalt did not show that these micro-elements had a beneficial effect on clinical cases of mædi, nor did they prevent the occurrence of new cases in flocks where these minerals were being fed.

The experience from the field seems to indicate very strongly that mædi is transmitted by contact from diseased to healthy animals. Several attempts have been made to transmit the disease to healthy sheep in the laboratory, and this we believe to have been successfully accomplished. With an infection of this type such experiments are time-consuming and require excellent facilities for isolating the animals over long periods of time.

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Our laboratory was not equipped with adequate isolation facilities for this purpose until 1948, and one of the experiments carried out before that time suffers from the fact that infection was carried between groups after the experiment was in progress, but in spite of this some valuable information may be extracted from this earlier work.

Our first transmission experiment was started in 1945 and lasted for 22 months. Three groups of five sheep each were inoculated into the lung and intranasally with material from two infected lungs, the third group received control material from healthy lungs.

All animals used in these experiments were purchased from an area where mædi has never occurred, and where they could not have acquired an active immunity to the infection. In this first experiment none of the animals showed any signs of the disease, and the lungs were macroscopically normal when they were examined 22 months after the inoculation. We now know that this was too short a period for macroscopical changes to develop.

The second experiment began in 1948 and was designed to test whether healthy lambs could be infected by contact with active cases of mædi. The results are shown in Table II. Two groups of five lambs each were kept in contact with a total of six cases of mædi which were rotated between the two groups for a period of three months. One of the experimental groups called A was fed a supplement of copper and cobalt twice a week while no such supple-

TABLE II

Results of contact infection experiments. Findings at autopsy.

	Sheep No.	Weight of lungs in grams	Infected with mædi	Specific deaths; months after exposure
Group A—Mædi and micro-elements ...	51	956	+	0
	62	965	+	30
	63	905	+	27
	76	930	+	28
	67	325	—	0
Group B—Mædi ...	52	600	+	0
	61	390	—	0
	64	Died from an intercurrent infection		
	66			
	68	530	+	0
Group C—Controls ...	69	1,275	+	0
	70	330	—	0
	71	500	+	0
	72	310	—	0
	77	860	+	0

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ment was given to group B. Beside, the two groups which we attempted to infect with mædi, a third group C was kept as controls. The three groups were kept in separate pens in the same shed. As in the first experiment isolation between the groups was inadequate for preventing the spread of air-borne infection between the animals. The sheep were bled monthly and the blood cells were counted in the usual way, and the hæmoglobin content was determined. Two of the sheep died from infections other than mædi during the experimental period; both were from the experimental group that did not receive any micro-elements.

Three sheep with symptoms of advanced mædi were killed at the end of the 27th, 28th and 30th month respectively. All had been ill for several months and they belonged to the group which received the supplement of micro-elements. The remaining animals were slaughtered 32 months after the experiment was begun.

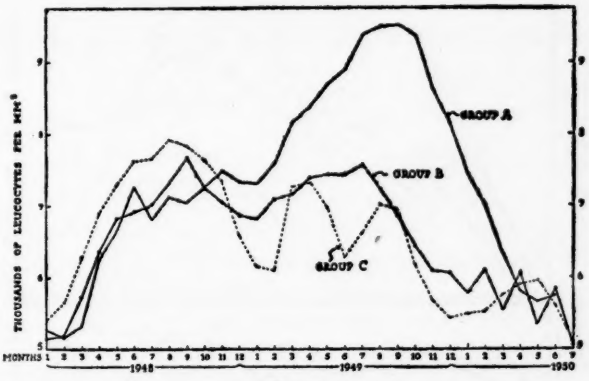


Fig. 5
The number of white blood cells in the three groups of sheep. The figures plotted are the average numbers for each group.

The results of the experiment as far as mædi morbidity is concerned may been seen from Table II. It will be seen that four out of five in group A, two out of three in group B, and three out of five in the control group contracted the disease. It is felt that the disease was definitely most severe in group A which also received copper and cobalt.

The leucocytes in the blood of the experimental animals were counted monthly and the figures are interesting, but difficult to interpret. The results for the three groups are shown in Fig. 5. There is probably an increase in the number of cells in all groups starting about three months after they were placed in contact with the infected animals; it is difficult to assess because the group which was intended as controls also contracted the infection. On the other hand it is quite clear that one of the groups developed a high level of leucocytes about one year before the onset of the clinical disease. This was the group which received a supplement of copper and cobalt, and three of the

animals belonging to this group were the only ones which died from mædi during the experimental period.

Figure 6 shows the variation in the white cell counts in the individual animals in group A. The three animals which became severely ill and died (numbers 62, 63 and 76) were the ones that exhibited a leucocytosis for at least a year before the disease had become clinically manifest. It should also be pointed out that the leucocyte counts began to fall again about the time when signs of lung involvement became clinically noticeable. In other words, by the time the process in the lungs had begun to threaten the life of the animals the leucocyte count was again approaching normal.

The two remaining animals in this group (numbers 51 and 67) did not show a comparable rise in their leucocyte counts; one of the sheep, No. 51, was at autopsy found to have mædi, but the other, No. 67, was considered normal.

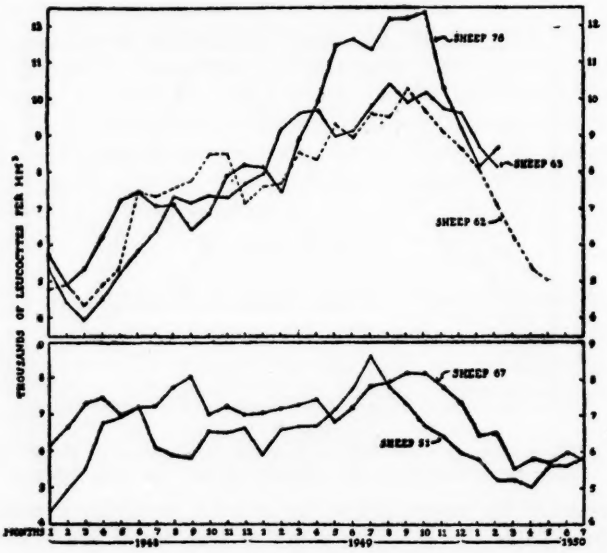


Fig. 6

The number of white blood cells found in each of the five sheep in group A. For clarity of presentation the three animals which showed a high leucocytosis during the latter half of the "incubation period" are placed separately. These were the same animals which contracted severe Mædi infection.

The five animals from group B and C which at autopsy showed mædi changes in the lungs, as seen in Table II, did not show any clear evidence of leucocytosis late in the incubation period. These animals had much more slowly progressing lesions in the lungs than did the animals in group A, which we have just been discussing.

The present experiment does not in itself prove that the disease was transmitted as the control animals also developed it. As already mentioned, however,

it was realised from the beginning that isolation facilities were not adequate for preventing the spread of airborne infection between these groups, over a period of two to three years. There is, however, ample evidence from other sources that the disease is transmitted from one sheep to another, and we believe that such has also has been the case here, and that the clinical incubation period varied from approximately 25 to 35 months.

Reference will be made later to the curious finding that protracted leucocytosis was found in some of the animals, which developed mædi, so long before any obvious signs of the disease were apparent. The fact that by the time clinical symptoms began to develop the number of white blood cells fell almost to normal again is particularly worth noticing.

The third experiment, summarised in Table III, was begun in March, 1949, and comprised seven groups of five lambs each. This time facilities were available for keeping the different groups in adequate isolation.

TABLE III

Findings at autopsy in the lungs of the sheep in experiment 3.

Groups	Kind of treatment	Number of animals	Average weight of lungs in grams	Probability that difference is by chance*	Typical microscopic lesions in:†
kl. 2, kl. 10 ...	Contact infection ...	10	352.5±16	<0.02	8/9
kl. 6	Fæces per os	5	394 ±20	<<0.01	4/5
kl. 12	Injected with mædi tissue	4	502.5±75	<<0.01	3/4
kl. 5, kl. 9, kl. 11	Controls	15	302 ±11		0/15

*Probability that the weight in each group is not significantly different from the weight of lungs in the control groups.

†The denominator indicates how many pairs of lungs were examined from each group. The numerator shows how many pairs of lungs were found showing the changes described in the text.

Two groups of five each were exposed to the infection by contact with active cases of mædi for a period of three months. One group was exposed by contaminating their drinking water with fæces from infected sheep. A fourth group was exposed by injecting it with an extract of lung tissue from a mædi case. This was done intravenously, intrapulmonally and intranasally. These groups of five each, i.e. 15 sheep in all, were kept untreated as controls. Each one of the seven groups was kept isolated in a separate isolation unit during the whole experimental period.

One sheep died from an extraneous cause. Thirty months after the experiment was begun the remaining 34 sheep were killed and carefully autopsied. None of the animals had shown any signs of disease during the experimental period, except one which had symptoms of mædi for a short period before the experiment was terminated. This sheep had been exposed by contact with typical mædi cases, and at autopsy *macroscopic* changes typical of the disease were found in this sheep and in this one only.

However, it was found that the average weight of lungs from all or any

of the experimental groups was significantly higher than the average weight of lungs from the control animals. Table III shows the average weight of lungs in the various groups. These differences are statistically highly significant and indicate that something was happening in the lungs of the exposed sheep which made them significantly heavier than the lungs from the control animals.

On microscopic examination most of the lungs from the experimental sheep showed characteristic changes that contrasted markedly with lungs from the control animals. The appearance of normal lung from a control animal is shown in Fig. 7.

The lesions seen in the lungs consisted of scattered infiltrations composed mainly of lymphocytes, plasma cells and monocytes (Figs. 8, 9 and 10). The infiltrates normally surrounded or were situated close to a small artery. Most of these infiltrates were not very massive, but in some cases inflammatory cells were seen lying free in the alveoli around the perivascular infiltrate constituting a rather characteristic micropneumonia. In other cases the perivascular lesions were not accompanied by intra-alveolar inflammation, and it is suspected that this is an earlier stage of the lesion (Fig. 11). The alveolar walls in these infected lungs seemed to be definitely more cellular than in the lungs of the control animals. Table III shows the number of animals in the groups that showed the typical lesions on microscopic examination. The lesions were found in the contact groups, in the injected animals, and also in the group that was fed fæces from infected sheep.

The conclusion seems inescapable that the lesions found in the lungs, combined with the increased weight of the infected lungs compared with the controls, is due to an agent transmitted in our experiment. It seems most likely that the changes in the lungs are early mædi lesions as they are all of the same kind, and qualitatively the changes are distinctly of the mædi type.

The lesson to be learned from this experiment was obviously that one should look for lesions in the lungs, long before the animal showed any clinical symptoms, and even long before lesions can be seen in the lungs with the naked eye. It seemed possible that the incredibly long incubation period was really not a period of inactivity at all but that extremely slowly progressing anatomical lesions were developing, perhaps all the time from the moment of effective exposure until clinical signs became noticeable. Biologically this seemed to be an attractive theory, and we set out to test it.

Ten lambs were injected with a suspension of typical mædi lungs at the age of six months. They received the material into the lung, into the nose and intravenously. Another group of ten lambs received corresponding treatment with a suspension from a normal lung. The animals were kept in four separate isolation units. By the time this experiment was begun it was known that it could only last for about 10 months, and the experiment was planned accordingly.

Table IV shows the results of this experiment. At varying intervals after the inoculation, groups of four lambs—two inoculated with mædi and two inoculated with normal material—were slaughtered and carefully autopsied. The lungs were weighed, and the left lung fixed by distending it with 10 per

cent formalin infused through the main bronchus. After fixation six pieces were cut from each lung at predetermined sites. From these pieces tissue sections were examined systematically under the microscope, and typical lesions were counted. The total area of these sections from each lung examined under the microscope was approximately 10 to 12 cm.^{2}

The lesions counted were distinct perivascular or parabronchiolar infiltrates, and/or light infiltrations with similar cells in the alveoli. Table IV shows the outcome of these counts, A and B representing the two sheep in each group.

TABLE IV

The number of typical microscopic lesions found in lungs of sheep from experiment 4.

	Number of microscopic lesions found in lung after:				
	10 days	30 days	90 days	210 days	285 days
Mædi					
A	0	12	80	2	0
B	19	3	4	18	0
Controls					
A	2	2	0	0	0
B	0	0	0	0	0

It seems likely that the findings 10 days after the inoculation should be considered non-specific results of the inoculation, which was both intravenous and intrapulmonal. The individual lesion, a perivascular infiltration and a micropneumonia, is not necessarily pathognomonic for mædi. However, the apparent accumulation of such lesion in the lungs of the mædi-inoculated animals, which were slaughtered 30 or more days after the inoculation, does suggest that they are due to the inoculation although the number of experimental animals is not large enough to prove this.

As previously stated the clinical incubation period for mædi is considered to be very long, 24 or more months. The results of this experiment indicate that lesions of the disease may be observed soon after infection, but that they progress so extremely slowly for many months that only the most careful microscopical examination will detect them. Under field conditions they could hardly be recognised because lungs of sheep living under natural circumstances quite commonly contain various types of minute lesions, which it would hardly be possible to distinguish from the incipient lesions of mædi. It is only by comparing lungs containing such lesions with lungs of control animals that have been equally strictly isolated, that we think that we have been able to distinguish these early lesions. The relatively virgin status of the lungs of sheep kept in strict isolation over long periods of time is reflected in their much lower weight, compared with lungs from animals living under field conditions.

Much work has been spent in our laboratory in trying to discover a specific antigen or a specific substance in the lungs of mædi-infected sheep. This is

particularly tempting because of the long latent period, which makes transmission work so time-consuming and tedious. Such an antigen, if present in the lungs, might be used in the complement fixation test employing sera from infected animals. Many methods have been tried for extracting such an antigen, but they have all met with failure. We have to assume that specific antibodies capable of combining with a specific antigen, if this were available, would be present in the sera of infected animals. This may, however, be a false assumption. It is possible that there is no specific antibody in the sera of animals affected with this disease and this could only be proven or disproven if a specific antigen were available; we are in a dilemma.

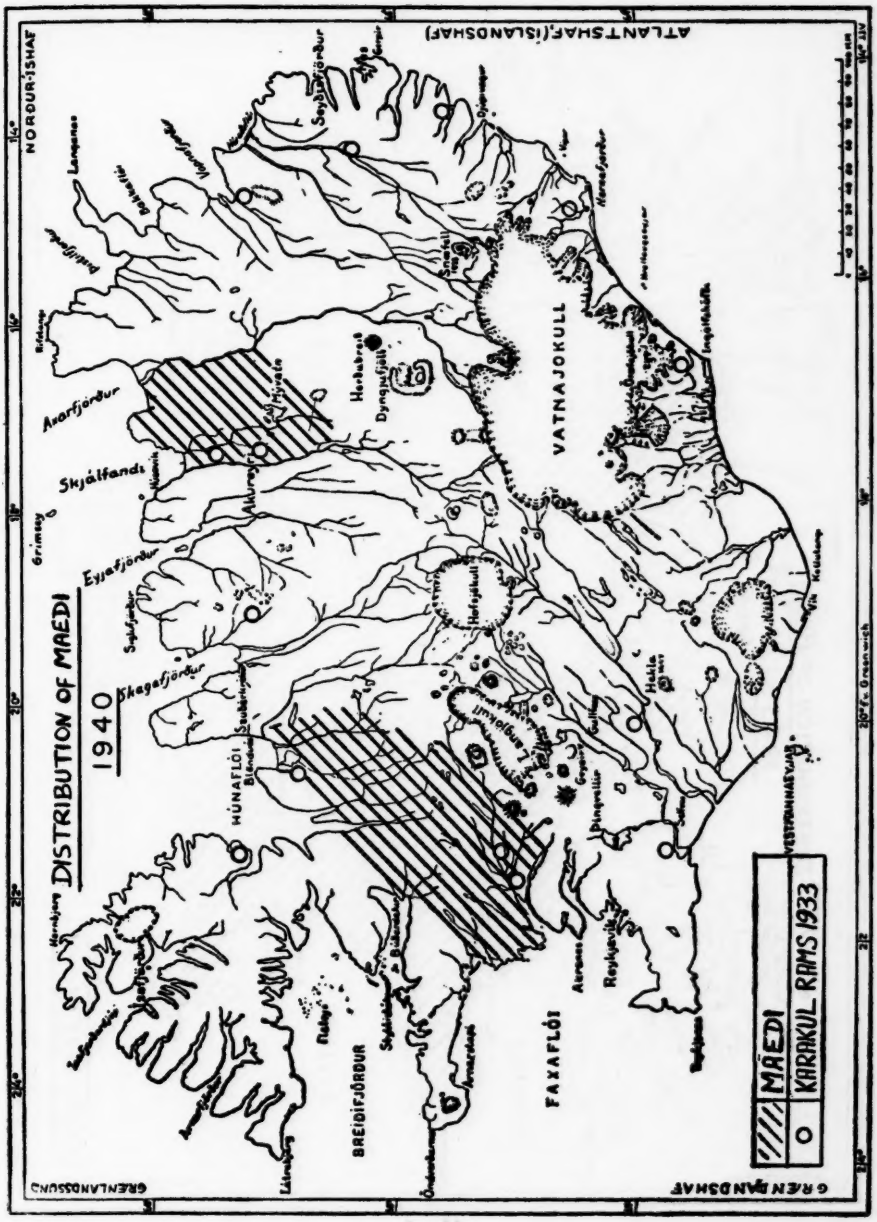
Considerable time has also been spent in searching in mædi lungs for a hæmagglutinating substance similar to those found in so many of the virus infections such as influenza. In this we have been successful, almost too successful. Employing different methods of extraction we have obtained no less than three different hæmagglutinating substances from the lungs of mædi-infected sheep.

All three agglutinins are active against chicken cells. Only one of them deserves to be mentioned further, because the others are found in normal as well as in mædi lungs. This third agglutinin which we have called α-agglutinin is extracted by a complicated procedure involving extraction of the minced lung at 70° C. and *pH* 8.5 with subsequent precipitation of the extract so obtained with ammonium sulphate at *pH* 5.5. The precipitate is dissolved in a buffered solution of *pH* 7.2 and centrifuged.

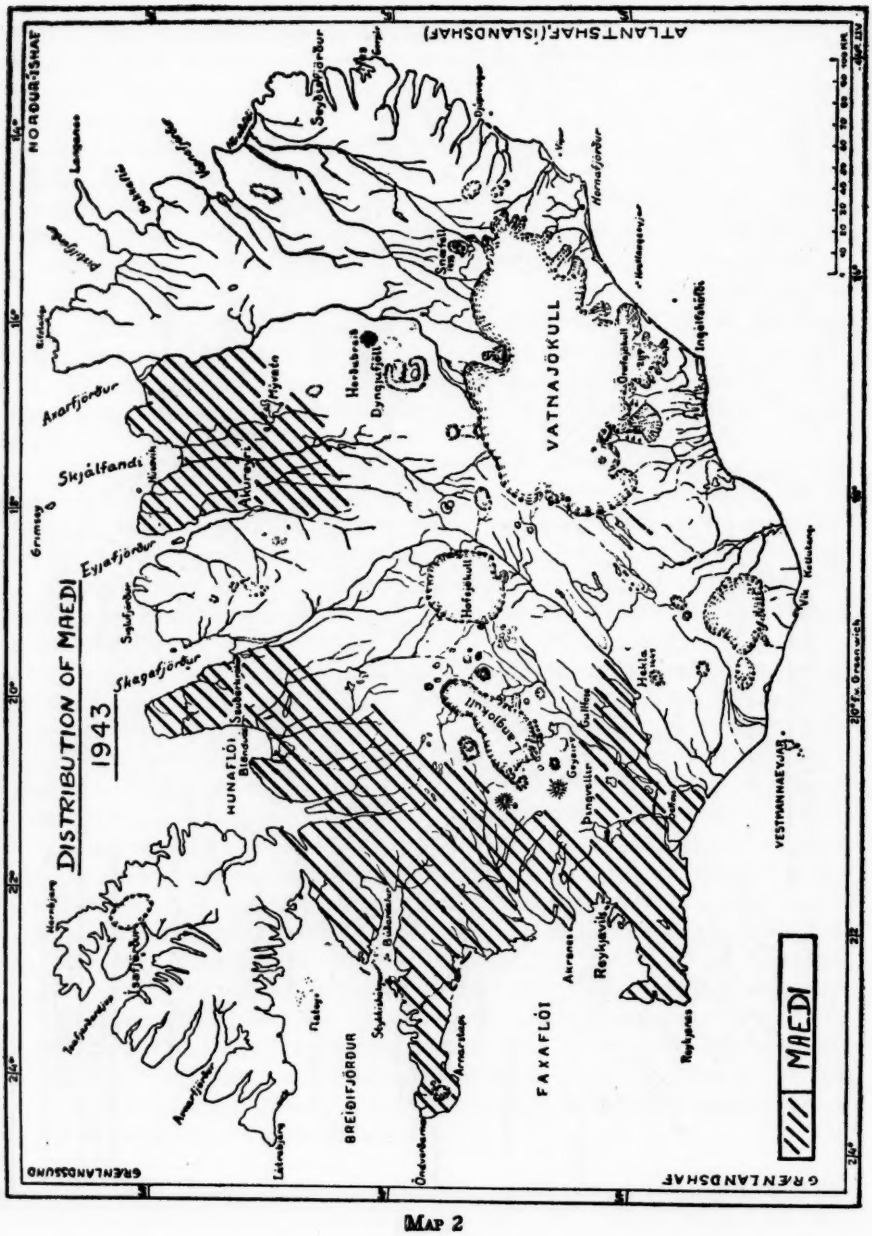
The agglutinating extracts are active against the red cells from a certain percentage of chicken only. These are cells of the so-called vaccinia positive type, but with suitable cells the extracts have titres up to 1 : 512 or more. The agglutinin has been found in a large number of infected lungs, and we believe that it is always present in such lungs. On the other hand we have never found it in the large number of normal lungs which we have tested.

Blood sera from cases of mædi will not neutralise the agglutinin. We are therefore not prepared to state that the agglutinin is a specific product of the virus of mædi. To a certain extent this agglutinin reminds one of the so-called lipid agglutinins extracted from normal tissue, by an entirely different method, by Stone in Australia and others. However, the behaviour of the mædi agglutinin differs in certain important respects from these lipid agglutinins, one of the chief differences being that it is not sensitive to normal sera. The significance of this substance is not yet clear, and at the present stage of our knowledge it is difficult or perhaps impossible to identify a substance of this type with a particular disease, unless neutralising antibodies are present, which could be employed for such identification.

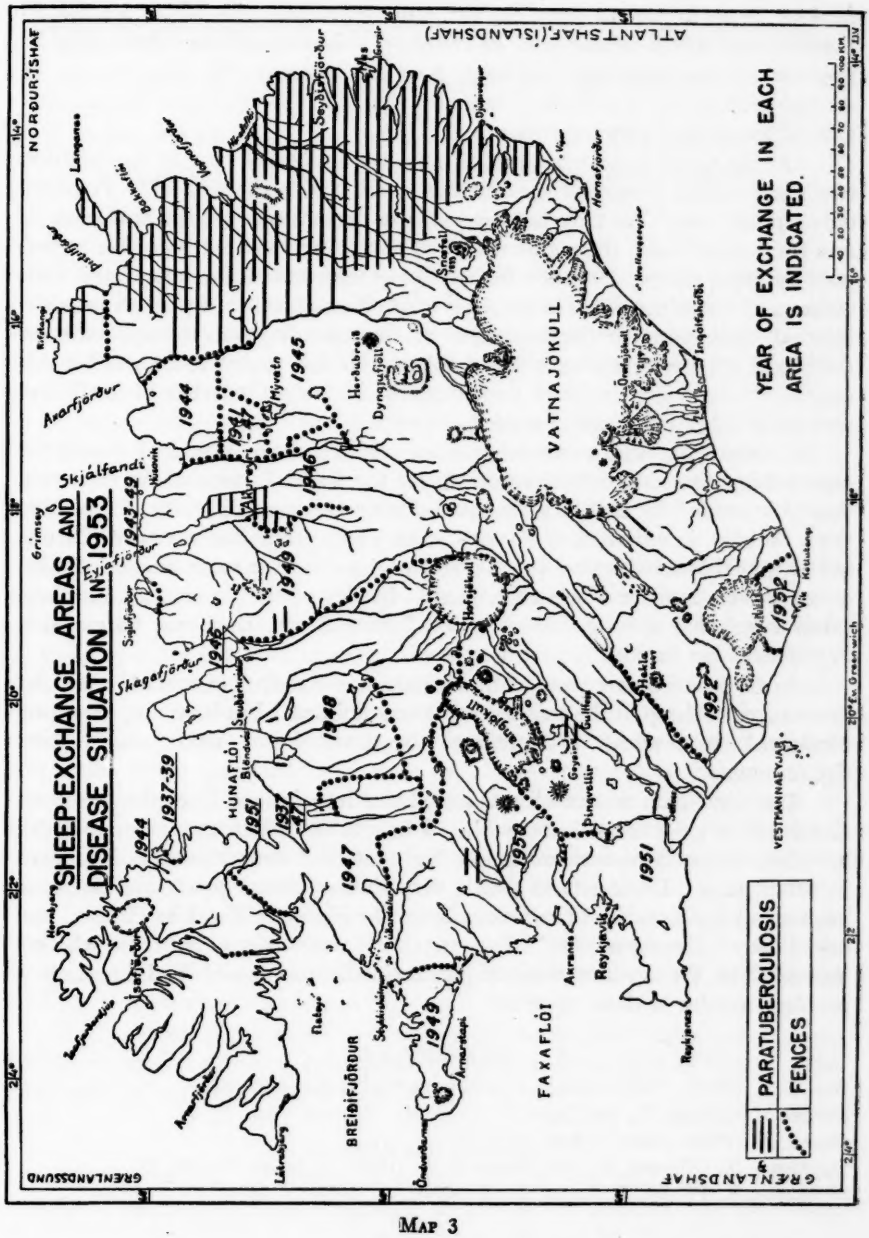
Maps 1 *and* 2 *show the distribution of mædi in Iceland in* 1940 *and* 1943 *respectively. The small circles indicate the farms where the imported sheep were originally placed. The third map shows the sequence of slaughtering in the various infected areas. No mædi is present. The horizontal markings in the east and elsewhere indicate infection with paratuberculosis (Johne's Disease).*


DISTRIBUTION OF MÆDI
1940
MÆDI
KARAKUL RAMS 1933
VATNAJOKULL
FAXAFLÓI
BREIÐIFJÖRÐUR
HÚNAFLÓI
Skjálfandi
Eyjafjörður
Skagafjörður
Arnarfjörður
NORÐUR-ÍSHAF
ATLANTSHAF (ÍSLANDSHAF)
GRÆNLANDSSUND
GRÆNLANDSHAF

Map 1


DISTRIBUTION OF MAEDI
1943
MAEDI
VATNAJÖKULL
FAXAFLÓI
BREIÐIFJÖRÐUR
HÚNAFLÓI
ATLANTSHAF (ISLANDSHAF)
GRÆNLANDSHAF
GRÆNLANDSSUND
NORÐUR-ÍSHAF
Ísafjarðardjúp
Arnarfjörður
Önundarfjörður
Skjálfandi
Eyjafjörður
Skagafjörður
Hvammstangi
Akureyri
Húsavík
Grímsey
Raufarhöfn
Langanes
Seyðisfjörður
Hornafjörður
Ingólfshöfði
Vík
Hekla
Hofsjökull
Langjökull
Reykjavík
Akranes
Reykjanes
Stykkishólmur
Búðardalur
Hólmavík
Blönduós
Sauðárkrókur
Ólafsvík
Grundarfjörður
Patreksfjörður
Bíldudalur
Þingeyri
Flateyri
Súgandafjörður
Bolungarvík
Hólmavík
Kópasker
Þórshöfn
Vestmannaeyjar

Map 2


SHEEP-EXCHANGE AREAS AND DISEASE SITUATION IN 1953
YEAR OF EXCHANGE IN EACH AREA IS INDICATED.
PARATUBERCULOSIS
FENCES
VATNAJÖKULL
FAXAFLÓI
BREIÐIFJÖRÐUR
HÚNAFLÓI
VESTMANNAEYJAR
ATLANTSHAF (ISLANDSHAF)
GRÆNLANDSHAF
GRÆNLANDSSUND
NORÐUR-ÍSHAF
Skjálfandi
Eyjafjörður
Skagafjörður
Arnarfjörður
Hornbjarg
Grímsey
Langanes
Rifstangi
Reykjanes
Ingólfshöfði
Hvítárvatn
Hofsjökull
Dyngjufjöll
Herðubreið
Snæfell
Öræfajökull
Grímsvötn
Kverkfjöll
Askja
Hekla
Geysir
Gullfoss
Þingvellir
Skjaldbreiður
Esja
Akranes
Reykjavík
Keflavík
Vík
Kötlugjá
Skaftafell
Lómagnúpur
Ingólfsfjall
Hafnarfjall
Snæfellsjökull
Látrabjarg
Patreksfjörður
Tálknafjörður
Bíldudalur
Arnarstapi
Ólafsvík
Stykkishólmur
Búðardalur
Blönduós
Sauðárkrókur
Siglufjörður
Ólafsfjörður
Húsavík
Raufarhöfn
Þórshöfn
Vopnafjörður
Seyðisfjörður
Djúpivogur
Hornafjörður
1944
1937-39
1951
1937
1947
1948
1946
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1943-49
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1946
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1943-49
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1946
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1937
1944
1937-39
1944

Map 3

The whole question of antigen antibody reactions in slow, progressive infections, is an important one. In the acute infections with which we are all familiar and which usually end in recovery, it is through the immunological response to the pathogenic microbe, primarily through the development of specific neutralising or inhibiting antibody, that the host terminates the infection and brings about its own recovery.

On the other hand what rôle, if any, do antibodies play in an infection like mædi which progresses continuously until it kills the animal? Probably only a minor one. We have not been able to demonstrate specific antibodies in sera from mædi cases; the reason may well be that we have not been able to prepare the right antigenic extracts for use in our tests, but on the other hand antibodies may not be present. The isolation of specific antigenic components from the infected tissue and the demonstration of corresponding specific antibodies in the blood, if present, are tempting problems. If this proves to be possible this approach should lead to better understanding of the pathogenesis of mædi and perhaps of other infections of a similar type.

I realise that the transmission work which I have described should be repeated and that the conclusions drawn are not final. In view of the extremely long time needed for each experiment and the consequent difficulty of repeating them we have, in our work since 1948, taken every precaution to insure effective isolation of the experimental animals and we have for the same reason included a considerable number of control animals. In view of the precautions that were taken I feel that the conclusions which I have drawn from our transmission experiments are justified.

As far as we know cases of mædi have not occurred in Iceland since the destruction of sheep in the infected areas was finished. We have not, therefore, considered it prudent to continue our transmission work under these circumstances.

The conclusion that mædi was introduced into Iceland from the European Continent in 1933 seems inescapable. I believe the future may show that this infection, which is of such extremely high potential destructiveness, lies latent in sheep there. I understand that a very similar disease producing the same anatomical lesions is found occasionally on the island of Texel in Holland and called there "Zwoegersziekte" (Bos, 1951). It seems to me that those who are interested in the obscure ways of epidemic disease, should find in mædi a problem worthy of their attention.

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THE OCCURRENCE OF THE NEURAL TYPE OF THE AVIAN LEUKOSIS COMPLEX IN EGYPT

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Reviews of the literature on the avian leukosis complex have been published by Olson (1940), Engelbreth-Holm (1942) and Furth (1946). The disease has been observed in nearly all poultry raising countries and the financial loss to the poultry industry equals, if not surpasses, that caused by all other poultry diseases (Barger and Card, 1943).

Chickens seem to be most susceptible although Jungherr (1939) observed a similar disease in ring-necked pheasants and Harris (1939) and Johnson (1941) have reported on the experimental transmission of the disease to pheasants. Andrewes and Glover (1939) recorded a case in a turkey, and Glover (1940) reported its transmission to chicks. All breeds of chicken may be affected and the highest incidence appears to be in fowls 4 to 10 months of age (Barger and Card, 1943). Clinical and histological evidence may be found in fowls from 2 to over 38 months of age (Dalling and Warrack, 1936) and one case in a 37-days-old chick has been reported (Biely *et al.* 1933), as well as in chicks 21 days old and in fowls in their second laying season (Biester and Schwarte, 1948). Burmester (1945) observed that, in chickens of the first generation the disease was most prevalent among females during the first 300 days, the incidence in females and males being approximately as 2 to 1. Burmester and Nelson (1945) reported on the effect of castration and hormones on the incidence of lymphomatosis concluding that male hormones implantations increased the resistance of normal males and capons to lymphomatosis. They thought that these results accounted for the lower incidence of the disease among males. There are no records of its occurrence among the local breeds in Egypt although Mohammed (1936) reported a case of the neural type in an imported Rhode Island hen which was brought to the Pathological Veterinary Laboratory at Giza for a diagnosis of its ailment.

The purpose of this paper is to record the occurrence, under natural conditions, of certain forms of this disease complex in birds bred in Egypt. The birds were of local and foreign stock.

Materials and Methods

During the first six months of 1953, a survey was made on all chickens coming to the poultry routine diagnosis section in this institute. In describing the various manifestations the nomenclature adopted by The United States Department of Agriculture was applied.

Avian-Leukosis Complex :—

(1) Lymphomatosis (*a*) Neural; (*b*) Visceral; (*c*) Ocular; (*d*) Osteopetrotic.

(2) Erythroblastosis.

(3) Granuloblastosis.

(4) Myelocytomatosis.

Details of the history, symptoms, if the bird were examined alive, and post-mortem findings suggested the presence of certain types of this disease in thirty-two cases. As the disease can be definitely established only by a histological examination, portions of tissues were secured for this purpose.

Results of Survey

Two manifestations of the avian leukosis complex, namely, the neural and the visceral were encountered among thirty-two suspected cases. Certain details are recorded in the following table :—

TABLE I

Post-mortem examination of thirty-two suspected cases of Avian Leukosis

No.	Breed and Sex	AGE Yrs.	Mnths.	Dys.	Organs affected and types of disease
1	R.I. Hen	1	6	—	Liver Vis. form
2	R.I. cross „	2	—	—	Liver and Spleen „ „
3	Balady „	2	—	—	Intestines and Right brachial plexus nerve Vis. and Neural forms
4	„ „	2	—	—	Liver Vis. form
5	R.I. „	1	—	—	Intestines „ „
6	Balady Chick	—	1	—	Heart „ „
7	Australorp Hen	2	—	—	Intestines „ „
8	R.I. cross „	1	—	—	Left brachial plexus and Left sciatic nerves Neural form
9	Minorca „	2	—	—	Liver and Intestines Vis. form
10	Balady „	2	—	—	Intestines „ „
11	Langshan Cock	1	—	—	„ „ „
12	Australorp „	1	—	—	Liver and Mesentery „ „
13	Balady Chick	—	2	—	Liver „ „
14	R.I. Cock	1	—	—	Proventriculus and Intestines „ „
15	Minorca Chick	—	1	—	Liver „ „
16	Balady „	—	—	20	Heart „ „
17	„ „	—	4	—	Liver „ „
18	„ „	—	—	20	Heart „ „
19	„ „	—	1	—	Liver „ „
20	„ „	—	1	—	„ „ „
21	R.I. „	—	2	—	„ „ „
22	Balady „	—	1	—	„ „ „
23	Minorca „	—	1	—	„ „ „
24	R.I. cross Hen	1	—	—	Liver and Spleen „ „
25	Australorp „	1	—	—	Intestines „ „
26	Fayoumi „	2	—	—	„ and Liver „ „
27	R.I. „	1	—	—	Liver „ „
28	Langshan Cock	1	—	—	Intestines „ „
29	Balady Hen	2	—	—	Intestines, Liver and Ovaries „ „
30	Fayoumi „	2	—	—	Intestines „ „
31	Balady Chick	—	3	—	Liver „ „
32	„ „	—	3	—	„ „ „

R.I. = Rhode Island; Vis. = Visceral; Balady = Egyptian breed.

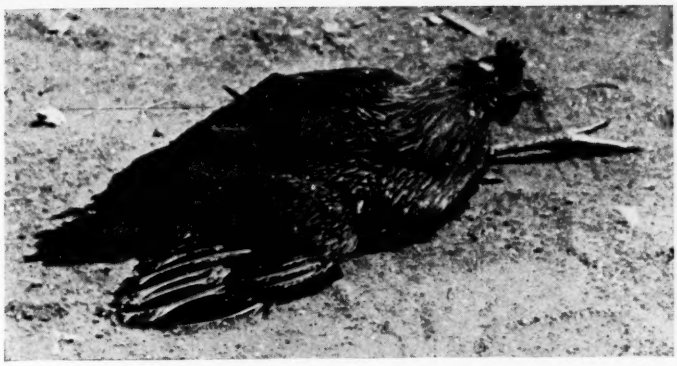

Fig. 1. Neural lymphomatosis. Both leg and wing on left side were affected, Case 8. Note that the left foot is extended forwards. This is a characteristic sign in an advanced case.

Fig. 1.

Fig. 2. Neurolymphomatosis. Common trunk of left brachial plexus and femoral portion of left sciatic nerves thickened. Case 8. Half natural size.

Fig. 2.

Fig. 3. Neural lymphomatosis in a Rhode Island cross hen. Longitudinal section in femoral portion of sciatic nerve. Notice the lymphocytic infiltration. x 200.

Fig. 3.

(Article by Soliman, Agroudi, Nadim and Halim, page 271)

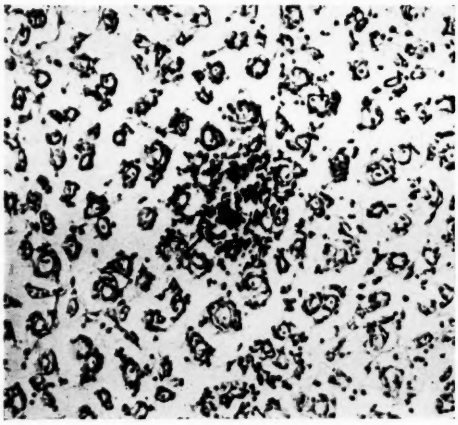

Fig. 4. Neurolymphomatosis in a Rhode Island cross hen. Transverse section in brachial plexus nerve. Notice the follicular lymphocytic infiltration. x 200.

Fig. 4.

Fig. 5. Suspected visceral type, in livers of cases Nos. 26 and 29, of the diffuse variety. Half natural size.

Fig. 5.

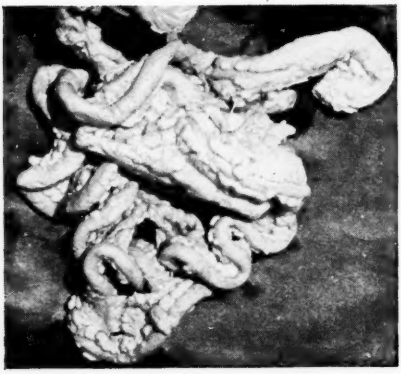

Fig. 6. Suspected visceral type in mesentry of Case No. 12. Half natural size.

Fig. 6.

(Article by Soliman, Agroudi, Nadim and Halim, page 271)

The Neural Type is commonly known as fowl paralysis and was first cited by Marek in 1907; the condition was verified by Kaupp (1921), Doyle (1926) and Pappenheimer *et al* (1926). Two fowls, namely 3 and 8, were affected with this form. The first indication of the existence of the condition came from the post-mortem examination of the first case which was a 2-year-old Balady hen. The post-mortem took place at the end of February, 1953, and the hen had been suspected of being affected with the visceral form. The right common trunk of the brachial plexus was slightly enlarged when compared with that on the left. Confirmation of the diagnosis by means of microscopic examination was not possible because the carcase was in an advanced state of putrefaction. However, inspection of the birds on the farm from which this case was sent led to the detection of the second case. This was a Rhode Island cross hen in its first laying season; the wing and leg on the left side were badly affected. According to Biester *et al* (1948) affected fowls have a tendency to hold one foot stretched forward or backward. This attitude was observed in this case (see Fig. 1). Post-mortem examination revealed a thickness of the left common trunk of the brachial plexus, as well as the femoral portion of the sciatic nerve, the latter being œdematous (see Fig. 2). No other abnormalities were observed. Microscopic examination of stained sections of the affected nerves revealed a lymphocytic infiltration, which is a characteristic feature (see Fig. 3). The infiltration was follicular and was most evident on examination of cross sections (see Fig. 4).

The Visceral Type occurred in thirty-one of the birds (see Figs. 5 and 6). One bird was suspected as having the Neural type as well. A study of the histopathological changes is being made to confirm the diagnosis of them all. Most of these cases came from the farm at which the Neural type occurred.

Discussion

The diagnosis of the first case, in a Balady hen, was based on post-mortem findings only. In the second, coming from the same flock, the histopathological changes confirmed the diagnosis. The clinical as well as the necropsy findings were typical of an advanced condition of the Neural type of the avian leukosis complex. Both cases were bred locally. The first was of a local breed, the second a cross one. Mohammed (1936) had stressed the fact that no cases of this disease group had been observed in local breeds in Egypt. He also warned the poultry breeders about the possible financial losses that might occur if the local breeds were affected and yet became established in the country.

Summary

The occurrence of the Neural type of the avian leukosis complex in two hens as noted, the first in a Balady breed and the other a Rhode Island cross locally bred in Egypt. Thirty-one cases, most of which came from the flock in which the Neural type was identified, were suspected to be affected with the visceral form.

Acknowledgments

Thanks are due to Dr. Zaki Mohammed, Director of the Veterinary Research Institute, Cairo, for his interest in the subject and to Mr. Aly Sami. Point Four, for his photographs.

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FURTHER OBSERVATIONS ON NEOPLASMS IN DOGS, WITH PARTICULAR REFERENCE TO SITE OF ORIGIN AND MALIGNANCY

Part II: Male Genital, Skeletal, Lymphatic and Other Systems

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An account of the 848 neoplasms of the cutaneous, female genital and alimentary systems in a series of 1,150 tumours from dogs, examined in the four-year period 1950-1953 in the Department of Pathology, Royal Veterinary College, London, was given in Part I of this paper (Cotchin, 1954). An account of the remaining tumours follows.

D.—Neoplasms of the Male Genital System

In the 77 specimens (see Table VI) were included 70 of testicular neoplasia, five of transmissible venereal tumours, a sarcoma of the spermatic cord, removed operatively from a Boxer dog, and a possible carcinoma of the prostate in a 5½-year-old Boxer dog—the latter animal, a monorchid, had a history of hæmaturia lasting up to three years. At post-mortem examination, an anaplastic carcinoma was found in and apparently originating from the right side of the prostate, with secondaries in the right descended testis, in the left iliac node, the intramuscular fascia behind the umbilicus, and in the lungs, but not in the brain or long limb bones. Carcinoma of the prostate gland (Julien, 1947) is an uncommon tumour in dogs but occasional cases are encountered.

TABLE VI

Classification of 77 Tumours of the male Genital Tract of Dogs

Testis		70
Tubular adenoma	35	
Seminoma	25	
Mixed tubular adenoma and seminoma	1	
Interstitial-cell tumour	7	
Hæmangioma	1	
Anaplastic carcinoma	1	
Transmissible venereal tumour		5
Prostate carcinoma		1
Spermatic cord sarcoma		1
		77

Five examples of transmissible venereal tumour were seen. This, the only important tumour of the penis of the dog, is transmissible naturally by coitus and experimentally by transplantation of viable cells (see Karlson and Mann, 1952). No causal virus has been definitely shown to be present. The lesion was apparently common in England 20 or more years ago, but is not often seen nowadays, although the condition appears to be endemic in some areas abroad. The neoplastic nature of the lesion is still not entirely certain. Bloom *et al.* (1951) consider that the cells present are mature end cells of reticulo-endothelial origin, while Jackson (1944/45) has suggested that the lesion is an apolar neuroblastoma.

There were 70 testicular tumours. These tumours in dogs have been well described by Innes (1942). The main types that occur are seminomas and tubular adenomas (Sertoli-cell tumours). The latter often have an œstrogenic effect. Coffin *et al.* (1952) have described a functional Sertoli-cell tumour in a 5-year-old male dog. The animal showed loss of hair, and was attractive to other male dogs. The teats enlarged, and the prepuce became pendulous. One atrophied testis was present in the scrotum, and the neoplastic retained testis was removed operatively. The symptoms regressed, only to recur four months after operation, due to the development of a metastatic lesion in the sublumbar lymph nodes. The dog showed squamous metaplasia of the prostate, and histological changes in the skin. The tumour cells contained fat which was stainable by Sudan IV, gave a greenish auto-fluorescence under U-V light, and was birefringent when viewed under polarised light. They concluded from these observations and from the symptoms that the material was œstrogen. Scully and Coffin (1952) give a very useful account of canine testicular tumours. They found 22 seminomas, 33 Sertoli-cell tumours, and 88 interstitial cell tumours (the interstitial cell tumours of the dog are described, with coloured plates, by Kunze, 1922). They pay particular attention to the histology and

histogenesis of the lesions. They trace the origin of the seminoma from the spermatogonia of tubules which have undergone pre-neoplastic atrophy, the seminoma cells extending within the tubules and invading the interstitial tissue. In some tumours they found obvious side-by-side neoplasia of spermatogonia and Sertoli cells. The Leydig cell tumours they trace to tiny foci of intertubular proliferation, which they think are properly called early neoplasms rather than foci of hyperplasia.

In this series, the neoplasms affected the right or left testis in equal numbers. The ages of the affected animals ranged from 2 to 18 years (ave. 9). Of the 62 animals whose breed was recorded, 22 were terriers, and 12 mongrels; the Spaniel (5) headed the list of other breeds.

Thirty-five of the tumours were classified as tubular adenomas (Sertoli-cell tumours), 25 as seminomas, one as mixed tubular adenoma and seminoma, seven as interstitial cell tumours, one as anaplastic malignant tumour, and one as hæmangioma. At least 20 of the testes in which tubular adenomas were present were ectopic, 11 being situated in the inguinal canal, and one in the abdomen. Only three of the testes showing seminomas were ectopic, and none of those with interstitial cell tumours. Twelve of the dogs bearing Sertoli-cell tumours showed signs of œstrogen activity—sex inversion with attraction of other male dogs (11), alopecia (6), enlarged prostate with squamous metaplasia (2), swollen teats (2), and atrophy of the unaffected testis.

Two of the testicular tumours were obtained post-mortem. A 15-year-old Cairn dog, destroyed with mitral incompetence, showed incidentally an interstitial cell adenoma in each testis. A 6-year-old Pekinese had been showing loss of condition, some vomiting, anorexia and dyspnœa, and had a large palpable mass in the abdomen when it was destroyed. The right testis contained an anaplastic malignant tumour, with similar tissue in two nodules under the capsule of the liver, and diffusely in the lungs. A seminoma and a Sertoli-cell tumour respectively were post-mortem specimens. The seminoma, which measured $10\frac{1}{2}$ x 7 cm., had metastasized to the iliac node (7 x $5\frac{1}{2}$ cm.).

E.—Neoplasms of the Skeletal System

A report on a series of 30 sarcomas of bone examined early in the four-year period under review has already been given (Cotchin, 1953*c*), and similar findings have been reported by Nielsen *et al.* (1954). A further 34 tumours of the skeletal system have been examined, making a total of 64. These later 34 specimens include 26 tumours of bone (rib 10, radius 5, tibia 3, humerus, femur, mandible, and vertebral body, 2 each). Post-mortem examination was made of 17 of the 26 dogs, and metastases were found in six—3 rib, 2 radius, and 1 femur case. The findings in this series of 26 were in accord with those previously reported (see Table VII). One of the specimens was a fibrosarcoma in the triceps muscle of a 13-year-old dog and one an intramuscular hæmangioma, from the right thigh of a Great Dane. There were six tumours apparently arising from tendon sheaths, which are classified as synoviomas. Four of them came from dogs examined post-mortem. A malignant tumour was removed

from the medial aspect of the hock joint of a 4-year-old mongrel bitch, but small nodular thickenings were felt under the skin at the time of operation, although the popliteal node appeared to be normal. These nodular lesions continued to grow, and had spread almost to the stifle joint when the animal was destroyed three weeks later. A synovioma was found in the muscle mass behind the femur of a 7-year-old Alsatian dog at autopsy. A synovioma was invading the compacta of the right humerus just below its head in a 12-year-old

TABLE VII

Site of origin of 64 Neoplasms of the Skeletal System

Bones		56
Rib	15	
Humerus	11	
Radius	9	
Femur	7	
Tibia	6	
Others	8	
Tendon sheaths and muscles		8
		64

mongrel bitch. A 6-year-old Retriever dog showed a number of neoplastic masses behind the right stifle joint, histologically seen to be synoviomas, and metastases were present in the lungs.

F.—Neoplasms of the Lymphatic System

(a) *Leukosis.*

Leukosis in domestic mammals occurs most often in cattle and dogs. In the latter species, most cases, if not all, appear to be of the lymphatic type, generally aleukæmic or only moderately leukæmic, and of a simple histological structure (see Jennings, 1953).

In this series, 40 of the 75 examples of neoplasia of the lymphatic system were cases of lymphatic leukosis; 28 of the affected animals were examined post-mortem. Taking all the dogs with leukosis, their ages ranged from 4 months to 13 years (ave. 6). 17 of the animals were known to be entire males, one a castrated male, and 17 females. Of the affected animals, nine were Scottish terriers, and seven were mongrels; no other breed was represented more than four times. Except for two cases with clinical symptoms lasting four and five months, the symptoms before destruction and autopsy had lasted only from one to seven weeks (ave. $3\frac{1}{2}$ weeks). The main symptom was of a generalised enlargement of the lymph nodes, in six cases definitely commencing with the neck region, with local œdema. Abdominal distension was due to enlargement of the liver and spleen. Other symptoms occasionally reported were poor

appetite, dullness, thirst, loss of weight, rapid or difficult respiration, vomiting, hæmorrhage into the anterior chamber, and fever.

At post-mortem examination, most of the carcase lymph nodes were affected, but the involvement of the visceral nodes was less constant. The lungs, affected macroscopically in two cases, often showed leukotic infiltrations histologically. The thymus was involved in a 1½-year-old Bulldog, measuring 13 x 10 x 10 cm. In a year-old Greyhound, there was marked involvement of the tonsils, which measured 5 x 2 x 1½ cm.; in this dog, the abdominal nodes and spleen were not obviously involved. An aged terrier bitch showed merely bilateral involvement of the prescapular and popliteal nodes, and a diffuse portal infiltration of the liver, the other nodes not being obviously involved. The clinical course of the disease in a 6-year-old Alsatian dog is of interest: three weeks before it was destroyed, acute œdema of the throat was seen, and the throat nodes were enlarged—tonsils and other nodes appearing normal. Two days later, the prescapular node was found enlarged, with local œdema, and a week later the popliteal node became palpable. Four days later, the inguinal nodes began to enlarge. At autopsy, widespread nodal involvement was found.

(b) *Spleen.*

True neoplasms of the spleen of the dog, as distinct from the common nodular hyperplasia, are uncommon, and are chiefly reported as some form of spindle-cell sarcoma (Ammann, 1937). Secondary neoplasms are not often found in the dog's spleen, although the organ is commonly involved in lymphatic leukosis.

Twelve examples of apparently primary neoplasia of the spleen were noted. They occurred in animals ranging from 5 to 13 years of age (ave. 10). Seven males and four females were included. The clinical history, available in nine cases, included enlargement of the abdomen (5 cases), vomiting (3), lethargy (2), loss of appetite (2), collapse (2), thirst, wasting and tympany (1 each). Four of the affected animals were examined post-mortem, and post-mortem specimens were received from another six. Two of the lesions were thought to be hæmangiomas, while the other ten were all apparently sarcomas. The latter tended to be large growths, occurring in the lower part of the spleen. For example, a lesion, a flattened sphere in shape, 16 cm. in diameter, was removed operatively from the lower margin of the spleen of an 8-year-old mongrel bitch, which had shown abdominal enlargement and listlessness for a few weeks. The tumour, which was thought to be most probably a leiomyosarcoma, had recurred and reached its original size six months later.

In five cases, there were secondary deposits in the liver. The sarcomas, apart from one reticulosarcoma, tended to be spindle-cell sarcomas.

(c) *Thymus.*

Neoplasms of the thymus (Blanchard *et al.*, 1939) seem most often to take the form of lymphosarcomas in the dog, and they may be associated with lymphatic leukosis when the latter condition occurs in young animals. Vasseur (1939), in a notable thesis, describes a thymus tumour in a dog in a series of ten cases from animals.

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Six examples of thymus neoplasms were seen in this series, five of which were lymphosarcomas, and one was probably a lymphoma. The ages of the affected animals ranged from $1\frac{1}{2}$ to 4 years (ave. $2\frac{1}{2}$). Four of the animals were female, two were male. The lymphoma occurred in an 18-months-old Great Dane bitch, which had a clinical history—of twelve months' duration—primarily of cough, followed by abdominal distension, chest dullness, ascites and progressive dyspnœa. The animal was destroyed, and showed a thymus tumour, pyramidal in shape, up to 18 cm. wide and 30 cm. long, lying ventral to the trachea and anterior to the heart, displacing the heart and lungs upwards and backwards. Another animal examined post-mortem was a 3-year-old male Sealyham, which had a two weeks' history of marked dyspnœa, and some swelling at the base of the neck; X-rays showed diffuse opacity in the thorax, and after thoracotomy had shown the thymus tumour, the dog was destroyed. The lesion, a lymphosarcoma, lying in the anterior mediastinum ventral to the trachea, formed a flattened oval mass 10 cm. long; deposits of lymphosarcoma tissue were present in both axillary nodes, the bronchial, renal, sublumbar, deep inguinal, mesenteric, ileocolic and gastric nodes, and the liver. In the case of the other lymphosarcomas of the thymus, lymphosarcoma tissue was present in other organs such as lymph nodes, liver, and kidneys, as well as in the thymus.

(d) *Others.*

The remaining 17 cases, which included 12 dogs examined post-mortem, and two from which post-mortem specimens were received, comprised six in which the mesenteric node appeared to be the primary site of neoplasia, and 11 cases of lymphosarcoma involving one (2 dogs) or more (9 dogs) lymph nodes but in which the diagnosis of intestinal lymphosarcoma, leukosis or thymus tumour was not indicated.

The six mesenteric lymph node tumours, which occurred in male dogs from 2 to 8 years of age (ave. under 4), comprised five lymphosarcomas and one liposarcoma. The latter occurred as a pyramidal mass, with sides some 6 cm. long, in a 5-year-old mongrel dog, which had shown acute abdominal pain, and a palpable abdominal mass, one week prior to destruction. A 6-year-old mongrel dog, which had shown anæmia, weakness, inappetance, diarrhœa and vomiting for two weeks prior to destruction, had a lymphosarcoma of the mesenteric node forming a mass 9 x 5 x 5 cm., with metastases in the sublumbar lymph node, pericardium, right ventricular myocardium, and in the ventral edge of the left lobe of the liver. No obvious lesion was found in the alimentary tract.

G.—Miscellaneous Neoplasms and Neoplasms of Uncertain Origin

(For a classification of these tumours, see Table VIII).

1.—Thyroid gland.

Neoplasms of the thyroid gland are seen predominantly in the dog amongst domestic animals, and they are particularly common in areas where goitre occurs. The important tumours are the malignant ones; these may be carcinomas, which tend to invade the thyroid and jugular veins, and easily

TABLE VIII

Classification of 86 Miscellaneous Tumours of Dogs

Thyroid gland			16
Carcinoma	8		
Adenoma	7		
Mixed thyroid tumour	1		
Urinary system			11
Kidney	4		
Carcinoma	3		
Lymphosarcoma	1		
Urinary bladder	6		
Carcinoma	2		
Fibroma	2		
Papilloma	1		
Leiomyosarcoma	1		
Urethral adenoma	1		
Respiratory system			10
Nasal chamber	6		
Carcinoma	3		
Sarcoma	3		
Lung carcinoma	(?)4		
Eye			7
Conjunctiva	3		
Papilloma	2		
Melanoma	1		
Globe	4		
Melanoma	2		
Ciliary body adenoma ...	1		
Epithelial tumour	1		
Nervous system			4
Choroid plexus carcinoma ...	1		
Meningioma	1		
Glioma	1		
Nerve sheath tumour	1		
Ear			3
Ceruminous adenoma	2		
Round cell tumour	1		
Adrenal			3
Adenoma	2		
Carcinoma	1		
Others			32
			86

spread by the blood stream, or they may be carcinosarcomas. Stünzi (1947), reviewing the post-mortem records of the Stockholm Royal Veterinary College from 1925 to 1947, found that 415 (6.6 per cent) of 6,325 dogs showed goitrous or neoplastic thyroid glands; 304 had carcinomatous lesions, and the thyroid (98) and mammary gland (34) were most often affected. Of the thyroid lesions, 251 were classified as colloid goitre, 46 as parenchymatous goitre, 17 as adenomas, three as sarcomas, and 98 as carcinomas. Twelve showed metastases—of these, eight spread solely by the hæmatogenous route; the lungs were affected in 11 cases. Kammer (1924) reviewed the post-mortem records at Berne from 1886 to 1922, and found 55 cases of primary thyroid carcinoma. Mixed tumours of the thyroid gland are discussed by Mason and Wells (1929), who reported a lesion in a bitch which was a mixture of adenocarcinoma and osteoid sarcoma; many metastases were found in the lungs—some consisted solely of carcinoma, some of osteoid sarcoma, and some had a mixture of both elements.

In this series, there were at least 14, and probably 16, examples of thyroid tumour, of which 14 occurred in male dogs, and only two in females. Six, and possibly eight, of the lesions were carcinomas, seven were adenomas, and one was a possible mixed malignant tumour.

The thyroid carcinomas occurred in dogs ranging from 7 to 16 years of age (ave. 9). Six were from animals examined post-mortem, and two were post-mortem specimens. Metastases were found in the right and left inferior cervical nodes and right olecranon process in one case, in the lungs and kidney in a second, in the lungs, liver and kidneys in a third, in a fourth there was a lesion in the ipsilateral head of the humerus, and in the fifth there was local invasion of veins. None showed obvious metastases in the brain.

The seven adenomas occurred in animals ranging from 3 to 13 years of age (ave. 8). The clinical features in three cases are described by Joshua (1953). Two other examples were found incidentally at autopsy. A suggested diagnosis of mixed thyroid tumour, probably malignant, was made for an operation specimen from the side of the neck of a 4-year-old Scottie bitch.

2.—Urinary system.

Of the 11 tumours, four originated in the kidney, six in the urinary bladder, and one in the urethra.

(a) *Kidney.*

Kidney tumours in animals are well reviewed by Flir (1952/53) and Stünzi (1953). Flir considers the incidence to be 1.7 per cent of recorded tumour cases in the dog, and refers to four reports of embryonal nephroma in dogs. Stünzi saw cases of carcinoma of the kidney in three male dogs, 3, 7 and 10 years old respectively. All three dogs showed hæmaturia, and the tumours were palpable and demonstrable by X-rays during life.

The renal tumours in this series included three carcinomas. These affected a male puppy, a 5-year-old bitch, and an 11½-year-old Scottie bitch. The first had metastasized to the lungs, the second was an operation specimen, and the third recurred locally two months after operative removal of the affected kidney,

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and had metastasized to the renal node and lungs. The fourth specimen was one of bilateral lymphosarcoma formation in the kidneys of a 5-year-old male Scottie—the appearance was similar to that seen in the so-called "sarcoma kidney" cases in the cat; the left kidney measured 8 x 5 cm., and the right 12 x 9 cm.

(b) *Urinary bladder.*

There were two fibromas, in a 6-year-old Spaniel bitch and an 8-year-old terrier-cross bitch, a papilloma in a 5-year-old male Labrador, a leiomyosarcoma in a 1-year-old mongrel bitch, and two cases of carcinoma. One of the carcinomas was in a dog on which a post-mortem examination was made. The animal, an 11½-year-old male Scottie, had a hyperplastic prostate, and is not reported to have shown hæmaturia; no metastases were present, although the tumour had infiltrated to the serosa of the bladder. The second carcinoma was a post-mortem specimen from an 8½-year-old Corgi bitch, which for some two months had shown increasing straining to urinate, and the passage of small quantities of urine which latterly were blood-stained. The animal, which was destroyed after exploratory laparotomy, showed no metastases.

(c) *Urethra.*

A small cystadenoma was an operation specimen from near the neck of the bladder of an 8-year-old terrier-cross bitch.

3.—Respiratory system.

There were six tumours of the nose and nasal sinuses, and possibly four carcinomas of the lung.

(a) *Nasal cavity.*

The nasal tumours were: (i) a squamous carcinoma of the frontal sinus of a 3-year-old Alsatian dog, with a few small metastases in the main lobes of the lung; (ii) a sarcoma of the left frontal sinus of a 7-year-old Labrador bitch; (iii) a carcinoma of the right ethmo-turbinate region of a 6-year-old male Cocker Spaniel, with extensive local spread, and metastases in the right zygomatic and right mandibular nodes, and invasion of the right temporal muscle; (iv) an adenocarcinoma of the nasal mucosa of a 6-year-old Alsatian bitch, with upwards spread to the orbit; (v) a spindle-cell sarcoma of the left nasal passage of a 3-year-old Great Dane; (vi) a sarcoma of the nasal septum of a 5½-year-old mongrel dog, with secondaries in the connective tissue alongside the trachea and in the lungs.

(b) *Lungs.*

Primary neoplasms of the lung are rare in animals. Jenny (1945, 1946) gives an extensive review of the literature, finding records of 70 primary lung carcinomas—including 29 in dogs, 18 in horses, 11 in cattle, six in sheep, and four in cats. Jenny notes the difficulty of diagnosis in bitches due to possible metastases of mammary carcinomas being present. Monlux (1952) gives a very extensive review of the literature, including a survey and discussion of 134 reported primary pulmonary neoplasms, with 21 additional cases from the Stockholm College. As regards the dog, Monlux found the age in 36 instances

to average 9.2 years; no particular sex incidence was recorded. In 12 cases, multiple foci were found in one or both lungs. The tumours were most often found in the main lobes. Metastases were reported in 22 of 39 cases, particularly in lymph nodes (the bronchial nodes in 14), but including various sites, e.g. the brain.

In this series, there were four possible cases of primary lung tumour, but only one of the animals came to post-mortem examination. Three of the cases were post-mortem specimens, and as they were all from bitches, the diagnosis of primary carcinoma remains doubtful. The case autopsied is of interest, as the dog was affected with acropachia. A 3-year-old Alsatian dog had, about one month before examination, shown a swelling of the left stifle region, followed subsequently by swelling of both forelimbs at the carpus. There was no cough, and the appetite remained good, although there was some loss of condition. After X-rays had shown lesions of acropachia, the dog was destroyed. In the main lobe of the left lung there was a solitary lesion, spherical in shape, 5 cm. in diameter, and partly cystic. In section, this was seen to be a carcinoma. In view of the absence of any other obvious tumour, and of nodal or multiple lung lesions, it is thought that this tumour was a primary lung carcinoma. Acropachia, which was present in this animal, is a condition seen most frequently amongst domestic animals in the dog. It is characterised by a slowly progressive and usually symmetrical thickening of the limbs due to the formation of periosteal osteophytes and dense fibrous tissue. The disease, which at first encounter may present a difficult diagnostic problem, appears chiefly in the course of chronic conditions usually, but not always, involving the lungs. The associated primary lesion that has been most often found in animals is one of tuberculosis, but the condition is associated in other cases with diseases such as neoplasia—not necessarily affecting the lungs—and in still other cases no obvious primary disease is found. The pathology of the condition is well illustrated in a paper by Stünzi (1952), who distinguishes acute and chronic forms.

4.—Eye.

Neoplasms of the eye itself (Léger, 1931) are uncommon in dogs. In this series, there were seven neoplasms. Two were papillomas—one at the corneo-scleral junction of an 8-year-old male Spaniel, the other on the conjunctiva of an 8-year-old male Scottie. A third tumour was a melanoma arising at the corneo-scleral junction of an Alsatian. The four tumours of the globe itself were: (i) an epithelial tumour of unknown type in the eye of an 11-year-old fox terrier; (ii) a ciliary body epithelial tumour of an 8-year-old Spaniel; (iii) and (iv) melanomas in the eyes of an aged terrier and of a 13-year-old mongrel respectively. The two latter had a structure similar to that seen in benign melanomas of the dog's skin; there was no history of recurrence or metastasis in the case of the terrier one year after the eye was enucleated.

5.—Nervous system.

Apart from a fibrosarcoma of the nerve sheath of the infra-orbital nerve of a 5-year-old male Spaniel (which also had a carcinoma of the thyroid gland and

tuberculosis of the anterior suprasternal node), there were three tumours in the brain. Two have been recorded elsewhere (Cotchin, 1953*a*, 1953*b*): a carcinoma of the choroid plexus of the fourth ventricle of a 6-year-old Shetland Collie bitch, and a malignant meningioma invading the cerebellum of an 8½-year-old miniature Poodle bitch. The third tumour was a glioma of the mid-brain of a 5-year-old male Dachshund.

6.—Ear.

Tumours of the ceruminous glands are occasionally reported (Black, 1949), but there is some difficulty in distinguishing neoplastic from hyperplastic lesions in an area where chronic inflammation may occur. In this series there were three tumours of the ear—a round cell sarcoma (?) inside the right auditory meatus of a 14-year-old male mongrel, and ceruminous adenomas in a 3½-year-old Dachshund bitch and a 9-year-old Cocker Spaniel bitch.

7.—Adrenal gland.

Tumours of the adrenal gland occur less often in dogs than in cattle, although nodular hyperplasia of the cortex is a common post-mortem finding. The polyuria and polydypsia described by Cohrs (1927) in a 14-year-old male dog with multiple different primary tumours, including one of the adrenal, were attributed to the chronic nephritis present. In the dog, an adrenal tumour may invade the local vein and grow a variable distance along the posterior vena cava.

There were three adrenal tumours. An adenoma of the left adrenal was an incidental autopsy finding in a 15-year-old male Cairn, as was a cortical adenoma in a 7-year-old Old English Sheepdog. The other adrenal tumour, apparently a carcinoma, was in a 12-year-old male Irish Setter. The lesion was in the left adrenal gland, with metastasis to the local lymph node, the lungs, and by the left side of the 5th cervical vertebra. There was local invasion of the posterior vena cava, presumably viâ the adrenal vein, to form a large bi-lobed structure projecting forwards towards the heart.

8.—Miscellaneous tumours and tumours of uncertain origin.

There were 32 examples. Nine of the affected dogs were examined post-mortem, and 12 others provided post-mortem specimens.

(a) *Neoplasms in the abdominal cavity.*

These included: (i) a possible neuroblastoma in the sublumbar region of a 1½-year-old Spaniel bitch, which by local pressure had caused marked hydro-nephrosis of the left kidney, and by upwards extension into the spinal canal had caused paraplegia; (ii) a sublumbar lesion, possibly a chordoma, was a post-mortem specimen from a 6-year-old cross-bred dog; (iii) a sublumbar sarcoma in a male Scottie; (iv) a sublumbar sarcoma in a ¾-year-old male fox terrier; (v) a sublumbar sarcoma in a 6-year-old male terrier. Other tumours examined were a liposarcoma of the root of the mesentery of a 9-year-old male mongrel, a mixed sarcoma of the root of the mesentery of a 9-year-old mongrel bitch, a sarcoma of the inner wall of the pelvis of a 4-year-old Alsatian bitch, and a sarcoma, with metastases, of the left broad ligament of an 11-year-old cross-bred bitch.

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(b) *Neoplasms in the mediastinum.*

There were two examples—a sarcoma of the pleura of a 4½-year-old Scottie bitch, and a fibrosarcoma of the anterior dorsal mediastinum in a 2½-year-old Alsatian bitch, which had spread upwards into the spinal canal.

(c) *Generalised.*

There were generalised hæmangio-sarcomas in the spleen, lungs, liver and myocardium of an 11-year-old Retriever bitch from which post-mortem specimens were received; the bitch died from rupture of the splenic lesion. A 12-year-old mongrel bitch at post-mortem examination showed generalised tumours, thought to be reticulosarcomas, in the lungs, liver, spleen, mesenteric node and kidneys (the brain was not affected).

(d) *Uncertain origin.*

There were nineteen examples, where the tumour remained of uncertain type, or was of uncertain origin, because insufficient material was available for examination.

Discussion

The body systems in which neoplasia had occurred can be divided broadly into two groups—those in which most of the neoplasms were obtained at operation (skin, female genital and male genital systems), and those in which most of the affected animals came to post-mortem examination (alimentary, skeletal and lymphatic systems). A series of post-mortem examinations by itself cannot provide definite evidence of the malignancy or otherwise of all the different kinds of tumours mentioned here—a complete post-mortem examination of every dog from which a neoplasm had at any time been removed would also be necessary—but the findings recorded here and in Part I (Cotchin, 1954) are sufficient to indicate that the important malignant tumours of the dog in this geographical area are, in the order they appear in these papers, sarcoma and melanoma of the skin, adenocarcinoma and other malignant neoplasms of the mammary gland, neoplasms of the mouth, particularly melanomas, and carcinoma of the tonsil, lymphosarcoma of the intestine, sarcomas of bones, and lymphatic leukosis. The preponderance of tumours of the lymphosarcoma type (including leukosis) and of sarcomas in general is striking, and in marked contrast, for example, to the incidence of sarcomas in man, which form only a small part of the total of malignant tumours. In man, too, carcinoma of the lung and of the alimentary tract is common, whereas in the dog carcinoma of the gastro-intestinal tract, although it does occur, is not common, and primary lung tumours are very rare.

Experimental study in dogs should be helpful in elucidating the general problem of neoplasia, and the above findings suggest that attention might well be paid in the first instance to the important malignant tumours of the dog—carcinoma of the tonsil, sarcoma of bone, and lymphatic leukosis and intestinal lymphosarcoma in particular.

Summary

An account is given of the 1,150 neoplasms from dogs that were examined

in the Department of Pathology, Royal Veterinary College, London, during the four-year period 1950-1953 inclusive.

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METHODS FOR REMOVING SKIN AND OTHER STAINS CAUSED BY CERTAIN MATERIALS USED IN VETERINARY PRACTICE

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QUITE a number of the materials in common use in veterinary practice leave unsightly, and in some cases, very persistant stains upon the skin. I have selected six, mercurochrome, picric acid, tincture of iodine, methyl violet, acriflavine and trypaflavine and as a result of experimental tests I have been able to indicate the best cleansers in order of merit.

Experimental Data

1. Solutions of mercurochrome 2 per cent in water, picric acid 1 per cent in water, tincture of iodine 2.5 per cent in alcohol, methyl violet in 2 per cent

acriflavine and trypaflavine in 5 per cent aqueous solution, were prepared for the production of stains on the skin.

2. Solutions of different materials (organic or inorganic, acid or alkaline, salt or liquid, oxidising, reducing or dissolvent agents) were also prepared for experimentation in removing the stains produced on the skin by the above mentioned substances.

3. Stains were made on the writer's own skin and on that of laboratory assistants in the departments of pharmacology and pharmacy, School of Veterinary Medicine, Fouad 1st University.

4. Attempts to remove these stains were made separately by rubbing the stained parts of the skin with a piece of cotton previously soaked in the prepared solutions.

Decolourising Materials	Strengths Used	Mercuro-chrome in %	Picric-acid in %	Tincture Iodine in %	Methyl violet in %	Acri-flavine in %	Trypa-flavine in %
Acids:							
Oxalic acid	5% in water	80	50	30	95	95	90
Hydrochloric acid ...	Diluted	50	30	15	95	90	90
Boric acid	5% in water	50	90	15	90	90	90
Organic materials:							
Alcohol	95%	50	70	90	95	90	60
Chloroform	Pure	30	50	70	95	70	40
Ether	„	30	20	50	90	40	30
Xylol	„	30	20	30	30	30	30
Glycerine	„	30	20	15	30	20	20
Inorganic materials:							
Hydrogen peroxide ...	1 in 3 of water ...	75	90	20	90	80	90
Ammonia solution ...	Dilute ammonia ...	70	90	100	95	80	80
Calcium chloride ...	5% in water	70	30	30	90	70	80
Potassium chlorate ...	5% in water	50	70	30	90	70	70
Potassium sulphate ...	5% in water	50	70	30	50	70	70
Calcium hypochlorite ...	1% in water	95	100	50	95	95	90
Sodium thiosulphate ...	5% in water	95	100	95	90	90	60
Borax	5% in water	90	90	60	80	80	70
Combined materials:							
Acidulated alcohol ...	10% of 5% oxalic acid in alcohol 95%	100	100	100	100	100	100
Ammoniated alcohol ...	10% of dilute ammonia in alcohol 95%	100	100	100	100	100	100
Alcohol and sod. thiosulph.	20% of 5% sod. thiosulph. in alcohol 95% ...	95	95	100	100	90	100
Hydrogen peroxide and ammonia ...	10% of dilute ammonia in dilute hyd. per.	100	100	100	95	80	80
Cal: hypoch. and oxalic acid	Equal parts of 1% of cal. hypoch. and 5% of oxalic acid	100	95	50	100	100	90

5. The materials and the strength of their solutions are tabulated as acids, organic materials, inorganic materials and combined materials. Their relative efficacy in removing the stains is recorded as percentages.

Summary

Generally, and arranged in order of decreasing efficacy, acidulated alcohol, ammoniated alcohol, hydrogen peroxide, ammonia solution, calcium hypochlorite, oxalic acid, sodium thiosulphate solution, ammonia solution, calcium hypochlorite and alcohol in the stated strengths are the most efficacious stain removers, whether for mercurochrome, picric acid, iodine, methyl violet, acriflavine or trypaflavine stains.

Acknowledgment

I acknowledge help from the late Dr. J. T. Edwards in revising this paper.

REVIEWS

PRINCIPLES OF VETERINARY SCIENCE, by F. B. Hadley, D.V.M. London: W. B. Saunders Company, Ltd. Price 27s.

THIS is a book which is intended primarily for agricultural students and practical stockmen. When one peruses the table of contents one is immediately conscious of the enormous field that the author has attempted to cover. I have not the slightest doubt that the farmer-reader who consults and digests the pages of this book will be able to appreciate the value of the service of his Veterinary Surgeon and take an intelligent interest in the steps necessary to prevent and cure disease. Probably the most useful sections for the agricultural student and stockman will be those which deal with:—

(1) Maintaining Animal Health. Chap. 12.
(2) Principles of Livestock Hygiene and Sanitation. Chap. 14.
(3) Hygiene of Breeding and Feeding. Chap. 15.
(4) Hygiene of Meat and Milk. Chap. 16.

These are concise and can be understood even by a person with an elementary veterinary training.

The parts which deal with Anatomy, Physiology, Pathology and diseases are too technical to be appreciated properly by a "layman." The illustrations are excellent but the same criticism could be applied.

Whilst the book is not designed for veterinary students I am certain that no veterinary student would suffer if he were to peruse its pages and he would profit much if he were to attempt to answer the list of questions at the end of each chapter.

Professor Hadley has attempted to put much into small compass. It may be that he has attempted too much. It may be that he has made it a little too technical for the appreciation of the average layman but if the latter profits

from even a tenth of the information presented the author has gone far towards his goal.

YADOVEETIE RASTIENEYA LUGOV EE PASTBEETZ. Akad. Nauk S.S.S.R. 1950. Price 29s.

UNDER the auspices of the Academy of Sciences, the Komarov Botanical Institute has recently published a book entitled "Poisonous Plants of field and pasture." The work gives the characteristics and distribution of poisonous plants in European and Asiatic Russia and describes the toxic symptoms arising from their ingestion, and is provided with indices of both the Russian and the Latin names. The line illustrations are adequate and the numerous maps are a great assistance to the text. In a short notice it is impossible to do more than point out a few of the interesting facts which come under review; Pteris aquilina, for instance, is distributed in a broad band across the whole of Russia from Finland to Kamchatka and from the mouth of the Don to the region of Lake Baikal. Its use as a bedding material accounts for numerous cases of poisoning. Ragwort is as common in Russia as it is with us. With the exception of mountains above 2,000 metres, it is found everywhere; the toxic symptoms are the same as those observed here. Numerous plants are, of course, peculiar to the country and Stellaria, Stramonium and Datura account for numbers of cases of poisoning, Datura also causing cases among poultry. Digitalis and the Aconites are widespread in distribution and Rhododendron grows wild in the Asiatic provinces and causes poisoning chiefly among sheep and goats, more rarely among cattle.

TURKEY DISEASES, by Dr. James E. Prier, D.V.M., Ph.D. Danville, Illinois: Interstate Publishers. 1953. Pp. 145. 51 photographs. Price £1.

THE American poultry industry is so large that we have come to expect many new publications from them, especially those which deal with disease. The author of *Turkey Diseases* comes from New York and graduated from Cornell University as Doctor of Veterinary Medicine. He holds also the M.Sc. and Ph.D degrees of Illinois University. In 1950 Dr. Prier was appointed Head of the Department of Veterinary Science and Bacteriology at the University of Wyoming, but he is now engaged in research on virus diseases at the Medical College of the State University, Syracuse, New York.

The diseases of turkeys are sufficiently mournful subjects in themselves, but this has not prevented the publishers from choosing an all black cover for this important new textbook. It is well bound, printed on good paper and there are many excellent photographs, but unfortunately there are almost as many which could be omitted, e.g. Figs. 2, 4, 16, 18, 26, 28, 31, 34, 35, 37, 42, 45 and 47. Figs. 21 and 22 show the reverse sides of a turkey suffering from Hexamitiasis, affected by severe depression. One such photograph would have been quite sufficient to illustrate this condition. Fig. 30 shows the removal of blood from the wing vein for Pullorum testing by means

of hypodermic syringe yet this is surely an unusual technique, even in Illinois? Figs. 38, 39, 40 and 41 all show acute Fowl Pox, but either No. 40 or 41 would have been adequate because both are excellent. In a similar manner Fig. 48 duplicates Fig. 46.

One must be critical, too, of the index because this is quite inadequate. There are no references to antibiotic supplemented feeds; choline; enlarged hocks; sinusitis infection; laryngo-tracheitis; the use of sulphaquinoxaline in coccidiosis; septicæmic diseases; red mites; coughing; kamala; fighting; feather picking; sterility, etc. Yet all these subjects are either mentioned or discussed in detail in the text.

The lists of references which are given at the end of each main chapter are very useful, but somewhat incomplete.

The author has tackled the subject of diseases in turkeys purely from the veterinary angle, although he does launch out into one aspect of poultry husbandry in Chapter 8 on "Breeding Problems." His remarks, however, are either discursory or too elementary to be of value to the investigating veterinary surgeon and there is doubt also as to whether some of his statements are true, e.g. "The most common causes of poor egg production and low fertility are nutritional."

As might be expected the specific infections, septicæmias, virus maladies, parasitic and fungus diseases are all dealt with systematically and in adequate detail, but it is such a pity that many of the practical problems of the turkey producer are neglected. There is, in fact, no discourse on pneumonia, chilling, impactions of the gizzard, curled tongue, clogged beaks, nephritis, etc.

An example of what one might call the purely veterinary approach to diseases is shown from Dr. Prier's recommendation where the prevention of *Paratyphoid* is concerned: "It must be remembered that all birds which are infected are not detected on the first or even second test (agglutination). Repeated tests are necessary. Since turkeys are usually secondary hosts, other carriers of the organism must be eliminated. A campaign to eradicate rodents, snakes, insects and other pests must be activated. A thorough disinfection of all equipment and pens must also be done . . . Even though a testing programme is enforced many birds will escape undetected and pass the organisms through the egg . . . One must not overlook man as a possible carrier of infection. So far as Paratyphoid is concerned, humans are usually mechanical carriers. Fæces and litter on shoes and clothing are excellent vehicles for organisms. Because of the multiple sources of bacteria in this group not only material originating from turkeys may be a source of infection, but also rodent's fæces, miscellaneous barnyard manure, etc., may be important contaminants." No wonder paratyphoid is difficult to eradicate.

This book is one which can be whole-heartedly recommended to the veterinary student anxious to gain some knowledge of the many specific infections of turkeys. It will be of less value to the turkey producer and the experienced veterinary practitioner.

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ITEMS OF CURRENT INTEREST

Veterinary Education

In the March, 1954, issue of the *Indian Veterinary Journal* a strongly phrased Editorial draws attention to the shortage of veterinary personnel in India. It calls upon the Government to take steps to make it easier for young men to pursue a career in veterinary science. The financial burden seems to be the main barrier in the way of students and the suggestion of the Journal is that it is the duty of the State to care for the welfare of animals in much the same way as it undertakes the welfare of human beings. Attractive grants to would-be veterinary students should be made so that the profession will have sufficient number of the right type of candidates.

The *North American Veterinarian,* May, 1954, discusses the position in America from a different aspect. The course of training for veterinary students is increasing in complexity due to rapid advances of medical and veterinary knowledge. Recent results of an examination showed a higher proportion of failures in basic scientific and veterinary knowledge amongst new graduates than has been experienced in the past. The Journal suggests there may be a danger of over-specialisation amongst students and it is necessary for these to acquire a concept of veterinary medicine as a whole, correlating anatomy, pathology and physiology before specialising in a particular branch. Remedial training is suggested for students who may be backward in basic education and it is thought that a course on the history of medicine would add to the cultural background of graduates, helping them in their professional and social contacts in later life.

New Research Station

The new Cooper Field Research Station at Berkhamsted Hill, which was opened on May 25 by the Minister of Agriculture, forms part of the Cooper Technical Bureau. The Cooper Technical Bureau as a whole is an integral part of Cooper, McDougall and Robertson, Ltd.

The first separate Cooper Research Laboratory was set up in Watford in 1905, but ceased to function during the war of 1914-1918. In 1918, an Information Bureau was established in London to supply all scientific information available on parasitic diseases of livestock and garden crops to the Company and its clients. A Field Research Station was opened at Little Gaddesden, near Berkhamsted, in 1929. In 1939, the Cooper Technical Bureau moved from London into new premises in Berkhamsted. Transfer of the Field Research Station from Little Gaddesden to Berkhamsted Hill was completed this year.

The Cooper Technical Bureau numbers some 40 qualified scientists on its staff, with an equivalent number of other assistants.

Principal members are:—
Director: F. A. Cooper, M.A., Ph.D., A.M.I.Chem.E.
Deputy Director and Chief Chemist: J. Allan, M.A., B.Sc., Ph.D., A.R.I.C.
Veterinary Surgeon-in-Charge, Berkhamsted Hill: W. Downing, F.R.C.V.S.
Overseas Scientific Liaison Officer: H. E. Harbour, B.A., M.R.C.V.S.
Head of the Veterinary Advisory Section is Mr. G. C. Brander, B.Sc., M.R.C.V.S.

NEWS

Dr. W. R. Wooldridge, M.Sc., M.R.C.V.S., F.R.I.C., Scientific Director of the Animal Health Trust, has been honoured by his profession in being elected President of the Royal College of Veterinary Surgeons. He is 53. Appointment is from June 1.

In 1942, when he was President of the British Veterinary Association (then the National Veterinary Medical Association) Dr. Wooldridge founded the organisation from which the Animal Health Trust developed.

NOTICES

As from June 18, Evans Medical Supplies, Ltd. are reducing the prices of Pradupen Oral Penicillin Preparations, Pradupen "50" and Pradupen "200." Particulars on application to manufacturers.

Allen & Hanburys, Ltd. announces reduced prices for Veterinary Alficetyn Capsules, Veterinary Alficetyn Buffered, Veterinary Alficetyn Dusting Powder and Veterinary Alficetyn Eye Ointment. Details can be obtained from the manufacturers.

Burroughs Wellcome & Co. announce the introduction of "Combestrol" brand Hexœstrol and Stilbœstrol (Veterinary) in the form of 15 mgm. implantation products for the chemical caponisation of poultry. Trials have shown that "Combestrol," containing both hexœstrol and stilbœstrol gives better all-round caponising results than either œstrogen used alone.

"Combestrol" is issued in containers of 25, 100 and 1,000.

At the Annual General Meeting of the Medical Sickness Finance Corporation Limited on April 27, 1954, it was reported that during 1953, 1,153 Agreements were entered into for a total of £417,777. Applications are considered not only from Medical and Dental Practitioners, but from Veterinary Surgeons, and others connected with the Medical Professions. The Corporation is a subsidiary of The Medical Sickness Annuity and Life Assurance Society Limited, and Sir Cecil Wakeley, Bart., is chairman.

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